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Electrical World

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THE gap is permanently maintained. Lubrication months apart is ample. The lubricant is under the load in starting. Soaked windings are prevented. Shafts are shorter and more rigid. Housings are more compact. Ventilation is better. *Thrust as well as radial load is handled in the modern anti-friction way.*

If this sounds altogether like a theoretically ideal motor design, remember that it is exactly what you get in electric motors equipped with Timken Tapered Roller Bearings. And today there is no other way of getting it all.

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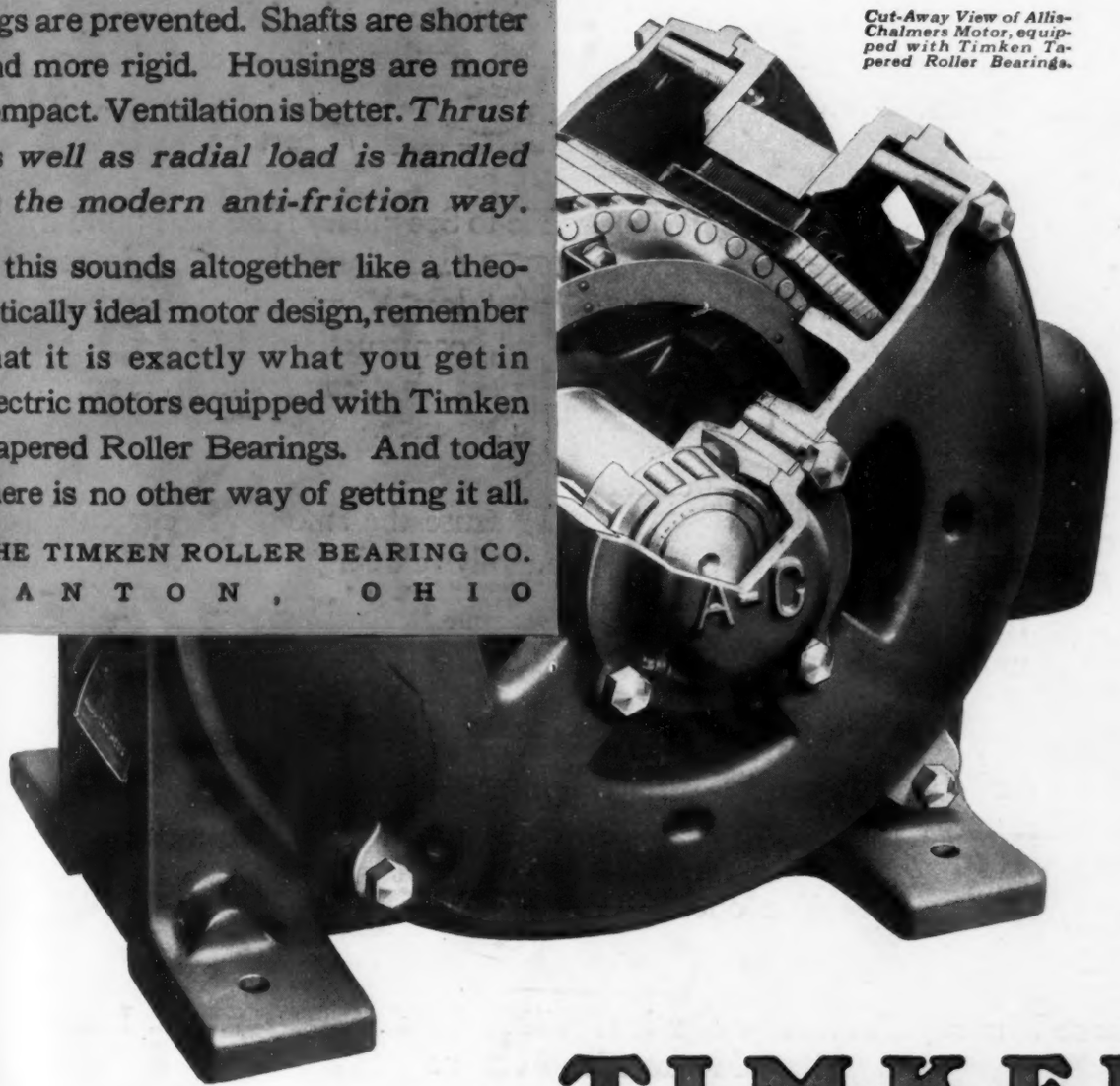
C A N T O N , O H I O

Cut-Away View of Allis-Chalmers Motor, equipped with Timken Tapered Roller Bearings.



TIMKEN
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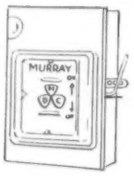
Ten MURRAY Protective Devices that "do help" in any distribution plan!

Switch to Murray Switches providing full safety—convenience—testing facilities — easy wiring — ample space for connecting up — save time and labor.



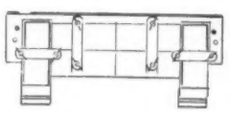
Save your income from loss by sealing meters—meter cabinets with this tamperproof seal. To remove it—it must be broken. Detection is certain.

Mount cables on a real rack offering flexibility, economy, protection against electrolysis because of porcelain insulator. Easy to change size of arms.

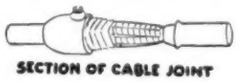
If you will place this cutout on your overhead lines you'll locate short circuit trouble quickly—limit rush of current to a minimum. Safe to operate.

Disconnect your services with Dummy Plugs—it's a wise thing to do. Inserted in place of fuses — make it unnecessary to cut wires—leave line open for ready reconnecting.

Easy to connect—disconnect—services with Sectionalizing Units — porcelain construction eliminates possibility of grounds — easy to install in the manhole.



Join up with this oil filled cable joint. Eliminate cable failures on your high tension lines — complete material supplied in 2 cartons.


SECTION OF CABLE JOINT

Tie-to Secondary Racks for building extensions—bringing in services. Economical rural line construction. Lowers cost adds strength and gives permanence.

Measure the amount of current by merely placing iron loop around cable and attaching to instrument. Gives instant readings without opening circuit.

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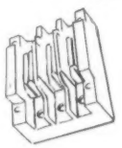

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Electrical World

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W. H. ONKEN, JR.
Editor

VOLUME 87 — *New York, Saturday, March 20, 1926* — NUMBER 12

Two Notable New England Achievements

TWO addresses given last week by C. L. Edgar and Samuel Ferguson to electrical gatherings in Boston and at Hartford record gratifying progress in fuel conservation through plant development and interconnection. In the best station of the Boston Edison company the coal consumption per kilowatt-hour has been falling in recent years to the present figure of practically one pound. It is not long since double this figure represented the best plant performance on the Boston system, and when such savings are applied to a mass production of energy like that absorbed in the Boston territory the result is conservation on a scale decidedly worth while. At Hartford attractive gains in plant efficiency have also been obtained, and ten months' operation of the well-known Connecticut Valley power exchange between the Hartford, Turners Falls and Springfield systems has saved these utilities more than 1,000 tons of coal a week through the interconnection of steam and hydro-electric stations. It is interesting and significant that Messrs. Edgar and Ferguson have yet to call upon their reserves in the attack upon fuel waste and that still further conquests are in sight by the aid of the more complete use of high-pressure steam and of the mercury boiler. More power to each!

More Connected Load Data Must Be Gathered and Studied

TO MANY central-station men connected load data constitute the proverbial pot of gold at the foot of the rainbow. Because such figures are elusive, constantly changing in values and more unreliable in residential service than in any other phase of company business, too many managers have given up the attempt to compile and maintain them in any systematic way. Some years ago annual connected load data formed a part of representative commission returns, but there is a tendency to release operating companies from reporting these data on the ground of their large "factor of guesswork."

We concede that efforts to keep connected load data in the residence field for entire systems as a routine activity are too costly to warrant their compilation. So far as the use of electricity in the home goes, it is more practicable to survey groups of residences, to study cross-sections of territory or to analyze conditions in selected localities. When one comes to industrial power and lighting, however, the situation is altered. The percentage of such customers is generally small enough in proportion to the total number to justify regular surveys for connected-load information. Reasonably accurate ideas of the value of different kinds of business demand concrete information upon the performance of specific connected loads, the assembly and interpretation of demand and energy consumption data, diversity factors, revenue and peak statistics. This is the price of any real understanding of service classifications. Certainly a start can be made with the larger industrial customers, and the growing intimacy between the central-station power sales engineer and the industrial user of electricity should be capitalized by vigorous efforts to get at the bottom of the use of service represented by the multitudinous combinations of equipment which make up the connected load of the modern power purchaser. Ragged work is too wasteful in this field of economic study to be tolerated by progressive executives.

The Refraction of Radio Waves

A STRIKING example of the importance of scientific research to the progress of engineering is afforded by recent investigations as to the properties of radio waves of different wave lengths. It is only a very few years ago that radio scientists were united in believing that the wave lengths best suited for long distance were those in the long or upper range. This opinion was based on numerous experiments on the strength of signal received at increasing distances from transmitters of short wave length; for example, the signal strength at 30 meters decreases rapidly with increasing distances from the transmitter, falling to useless values at about 70 miles. As time went on there were an increasing number of reports from amateurs working on short waves that stations at distances far greater than that mentioned were being picked up. The transatlantic tests at short wave lengths, for amateurs, were the outcome of this difference between the early opinion of experts and the results of experience.

Recent studies on a large scale have now revealed that radio waves are bent or refracted in the upper atmosphere, much in the same way that light is bent when passing over highly heated ground, as, for example, in the mirage which sometimes renders objects far beyond the horizon visible. In accordance with this principle it now appears to be definitely established that some of the waves from a short-wave transmitter proceed rapidly outward, and these are the waves which are rapidly damped out. Some of the waves go upward into space at too sharp an angle to be refracted, but at an increasing angle with the vertical a value is finally reached in which the waves are refracted and brought back to earth at, say, 500 miles from the transmitter, at which point the signal becomes strong again. There is thus a region between 70 and 500 miles in which no signal is heard. Beyond the 500 miles there is a long region, upward of, say, 5,000 miles, over which the short wave-length signals may be heard under good conditions.

These effects are explained by the investigators as being due to the presence, high up in the atmosphere, of a region in which there are a large number of free electrons. This is the so-called Kennelly-Heaviside layer, as described in these columns some time since.

The layer is by no means definite in thickness, distance from the earth or degree of concentration of the electrons. Thus at times the refracted wave may come back to earth within the limit of the ground wave. In this case there may arise a difference in phase or interference between the two waves, and this is assumed to be a chief cause of the so-called "fading" of received signals. Investigations of the properties of short waves have not only expanded greatly our knowledge as to the nature of transmission processes, but have also very greatly increased the field of radio application.

What Is an "Active Socket" in the Home?

IN CONSIDERING central-station revenue from residence lighting it is obvious that sockets vary not only in "connected load" but also in their "activity." The connected load is a very definite quantity, which is the wattage of the lamp. Activity, or the average daily, monthly or yearly period during which the socket is active, is less accurately known, although it is of primary importance. This period multiplied by connected load is the direct measure of revenue. Many data have become available recently pertaining to connected load at various sockets, net revenue from some particular sockets and other interesting factors, and commercial men are beginning to use the term "active socket."

The definition of an active socket must be arrived at through usage or by common consent, and therefore it may be too early to formulate it. Obviously, the sockets in the attic, in closets and outdoors may be considered of lowest activity and may be termed inactive sockets for the sake of brevity. On the other hand, those in the kitchen, in the ceiling fixtures in the dining and living rooms, in certain portable lamps in the living room, and in the bathroom, represent the most active sockets. By specifying a certain average number of operating hours per year a group of sockets could be represented in terms of equivalent active sockets. For example, there are two and three-tenths sockets in the average bedroom, or a total of nearly six sockets in the bedrooms of the average home. These six sockets might have a combined activity equivalent to two active sockets, depending upon the definition of an active socket.

Exclusive of attic, closets, exterior and garage, an average of about twenty-two sockets exists at the present time in wired homes. The total operating lamp-hours per year per home is about seven thousand; that is, the total activity of sockets is equivalent approximately to about seven sockets, each operating about one thousand hours per year. If one should arbitrarily choose to define an active socket as one which operates one thousand hours per year, the twenty-two sockets per home would be equivalent to approximately seven active sockets. The sockets in a portable lamp used in the living room for reading would have to operate on an average of two and three-quarter hours nightly to be the full equivalents of active sockets. With such a definition each socket in the home could be supplied with a factor which would represent its fractional equivalent of an active socket. This factor would be less than unity in most cases. There is a need for defining the active socket, and it is hoped that by usage or otherwise this will eventually be achieved.

Less Expensive-Looking Household Appliances

A GOOD many persons think that the sale of household electric heating appliances is being restricted by the lack of a "cheaper-looking" line. The highly finished nickel percolator and toaster, they say, are too often reserved for use "when company comes," while the old coffee pot and stove appliances bear the burden of the three meals a day. They believe that there should also be some less expensive-looking electrical appliances that will encourage daily use.

Perhaps this is true, for undoubtedly the electric shop is handicapped today by the narrowness of the line and the limited price range. As a result there is very little opportunity to exercise the shopping art in the electric store except in considerations of price or fine points of design. Less expensive-looking appliances would undoubtedly make a strong appeal to many buyers. And it is doubtful whether they would interfere at all with the sale of the present lines. They would tap a new stratum in the market, just as is the case with other kinds of household equipment.

Value of Range Load

COMMERCIAL electric cooking and baking constitutes such a promising field of load development for utilities that the subject of range load cannot be dismissed without considering it. In fact, in some of the larger cities it may overshadow in opportunity the possible revenue production from domestic ranges, if the number of leased homes and apartments predominates over owned homes. The possibilities in this direction, the value of the load to utilities, experience gained from existing installations, status of present development, organization of sales forces to develop the business, advantages to users, load characteristics and rates, installation of equipment, operation and serving, are all being analyzed by the N. E. L. A. commercial cooking committee, and serial reports recording results of investigation will be issued from time to time. A report entitled "Sales Plan" has just been published.

Next to appear will be a report showing typical installations. The installations will be illustrated, and, what is more important, they will be accompanied by 29 pages of data which can be used by utility representatives to show what has been done in various parts of the country in the hotels, clubs, restaurants and cafeterias, factories, hospitals, bakeries and so forth. Among the information which will be included, where it was obtainable, will be (1) connected load, (2) monthly consumption, (3) monthly bill, (4) maximum demand, (5) kilowatt-hours used for power, light and heat, (6) average rate per kilowatt-hour, (7) fuel rates, (8) load factor, (9) number of meals served, (10) consumption per meal, (11) average cost of electricity per meal, (12) average meal check, (13) number of hours' use per day, (14) number of bakers, (15) number of chefs, and (16) output. In addition, each installation will be identified as regards its location and the equipment used. Following this will appear a record of a much greater number of installations, showing the equipment installed and the rating.

Of greatest interest to executives, after accomplishments have been shown, will be specific illustrations of the desirability of the load. Such factors as revenue

per dollar of business, cost of serving business, operating cost, relative importance of load, possibilities of increasing the load, load characteristics, present development, typical experiences of utilities and indorsements of this business activity by utility executives will be compiled and presented.

Just as an example of what has been done, there are in one city alone about 70 hotels, clubs, restaurants, cafeterias, factories, hospitals and bakeries which now use electric cooking or baking in various degrees. The hotels and restaurants are about equal in number, totaling 60 per cent of the installation, bakeries ranking next in number and clubs next. In the last two years more load of this character (figured in consumption) has been attached than in the previous five years, a fact which shows what momentum has been gained. The maximum load for cooking and baking exclusive of light and power is about 4,000 kw., and the billed consumption is estimated at about 720,000 kw.-hr. per month. The ratio of demand to connected load for the aggregate cannot be accurately figured, but check meters on individual installations have shown a range of 50 to 60 per cent, with load factor of 8 to 62 per cent. The average billed revenue from this business has been 1.8 cents a kilowatt-hour.

Bakeries present the least sales resistance, hotels, clubs, restaurants and cafeterias the next lowest, and factories the most. In value of load, however, hotels, clubs, restaurants and cafeterias as a group rank the highest because of the magnitude of use. Factories and hospitals come next, and bakeries rank less high.

The cost of obtaining this business can be calculated only by considerable reaccounting as it includes salesmen's salaries, their expense accounts, advertising, use of check meters, instruments and tests for getting sales data, etc. It may be said, however, that the business described was gained with virtually no advertising and with only one utility sales engineer, who worked in co-operation with manufacturers.

Insulation in Used Machines

THE standards of the American Institute of Electrical Engineers and other similar rules or specifications prescribe a definite high-potential test for new electric generators and motors. Much can be said for and against subjecting insulation to a higher stress than it ever will be called upon to stand in actual operation, but at any rate the specified overpotential is a perfectly definite guide for the maker and the user of a machine. However, when it comes to a machine already in use the situation becomes quite indefinite. A used machine may be subjected to a high-potential test either as a part of periodic inspection or on special occasions—for example, after repairs to the winding or a change in connections.

Since even the best known insulation deteriorates with time, it would hardly seem rational to subject a used machine to a high-potential test of the same severity as a new machine. At the same time, when a machine is performing an important duty the operating engineer prefers to know of an impending failure in advance rather than to wait until the machine actually breaks down at an inopportune moment. To test it "destructively" is to invite such a failure, but apparently there are no reliable non-destructive physical tests to indicate the condition of insulation. Measurement of insulation resistance is not always indicative, and even a high-potential direct-current test with a kenotron may give a false assurance, since the dielectric loss is absent.

This question of dielectric tests on used machines is of considerable importance to public service companies and to users of large electric motors in various industries. With it is closely connected the problem of finding a non-destructive physical test indicative of an incipient deterioration or of the state of preservation of the insulation. The time is ripe to engage in thoroughgoing research in this direction.

Radio Interference

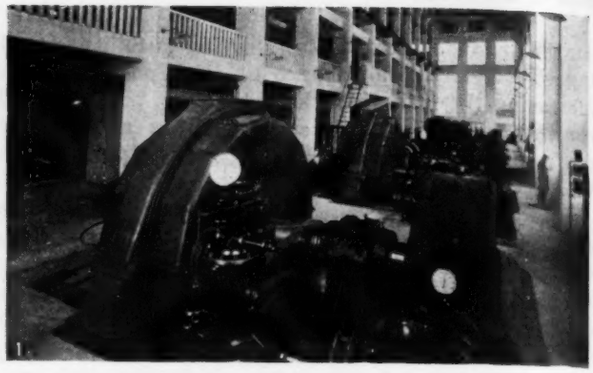
MORE and more extensive use of radio and the increasing adoption of supersensitive sets have forced a new problem of considerable magnitude and seriousness on power utilities, involving trouble which is hardly deserved and greatly complicating public relations. Users of radio sets—and they number millions—sometimes find it well-nigh impossible to receive broadcast programs without irritating interference. Not knowing the cause and sometimes ignoring an obvious one, or persuaded by some would-be radio "trouble shooter," the user attaches the blame to the power companies, despite the fact that investigations have shown the interference to be caused more frequently by local transmitting equipment, internal troubles in the user's set or oscillations established by faulty electrical appliances or circuits in his home.

To escape undeserved criticism, utility companies, it is hardly necessary to point out, find it always more effective to consider the complainer's viewpoint and to make the public realize that this attitude is the one taken than to assume a defensive stand. This is true regarding any situation in which the public is much interested. The question is how far a utility can economically go in co-operating with the public in ascertaining the cause of radio trouble, considering how little, if any, the company contributes to the interference. As established by experience, running down the trouble takes considerable time, but this time will frequently be well spent because it will bring public good will and put an end to possible service interruptions. Every utility company desires to eliminate interference that causes ill feeling and to discover any condition on its system which has potential possibilities for service interruption or which results in increased expense.

There are several ways in which a utility can receive aid in "trouble shooting" in the case of interference to which it is not a contributor. One is by co-operation with radio interference leagues and other radio groups that show themselves to be fair in weighing causes of interference. To such leagues co-operation can be given by imparting information that will enable radio users to determine whether the trouble is inside their set, inside their home, caused by other radiating equipment or by power lines. From the mass of data already collected it might even be possible to list the various causes of interference and indicate their symptoms. Such information might also be mailed with customers' sets and published in the newspapers. By such co-operation as this it is more than likely that radio interference, which now appears to present an insurmountable problem, will be the means of uncovering conditions which a utility company would want to remove any way and will intensify friendly relations with the public by helping it in a problem it has much at heart.

Mangahao Power Project, New Zealand

IN ITS 102,000 square miles of area New Zealand possesses some very interesting hydro-electric possibilities. The southernmost of the two islands can promise nearly 5,000,000 kw. and the other about 1,000,000 kw. The illustrations on this page are of the Mangahao development of 24,000 hp. on the north island, which is the more thickly settled. Two further projects are in immediate contemplation—Arapuni, 120,000 kw., and Lake Waikaremoana, 96,000 kw. The cost of Mangahao to its present capacity has been approximately $7,775,000.



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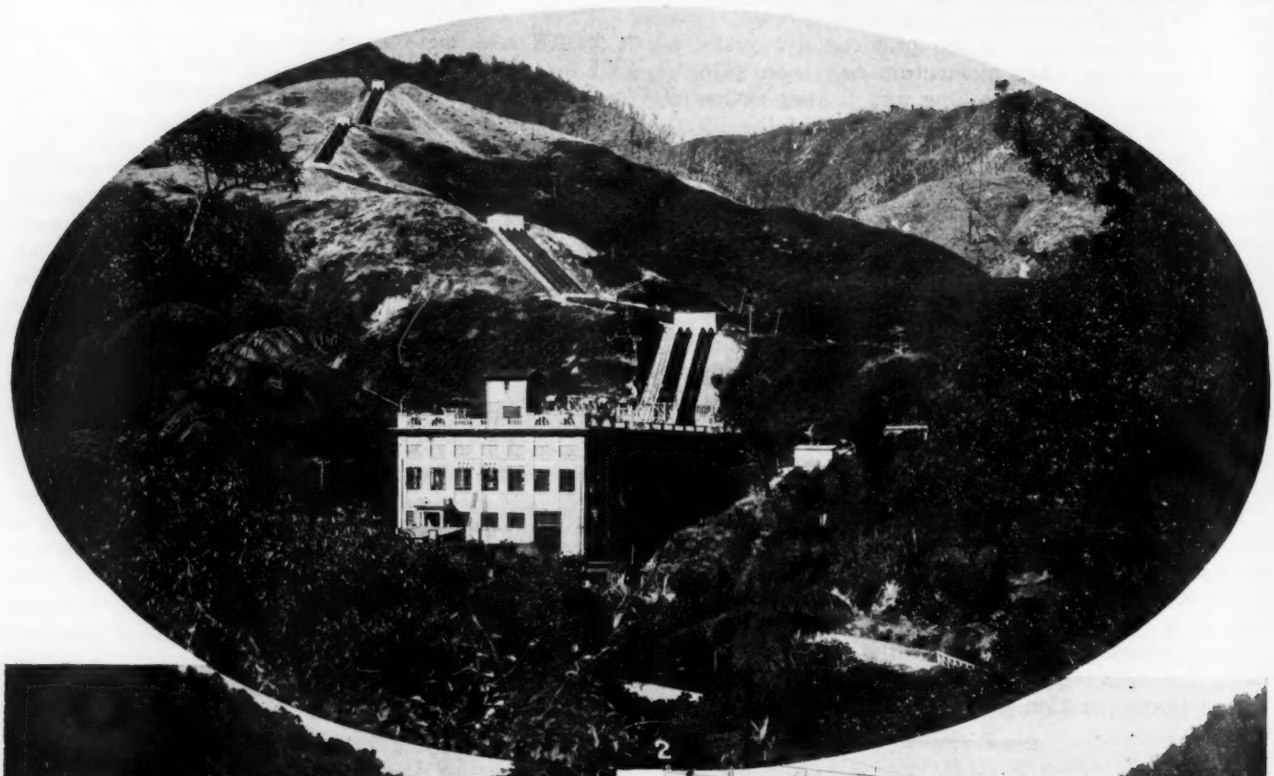

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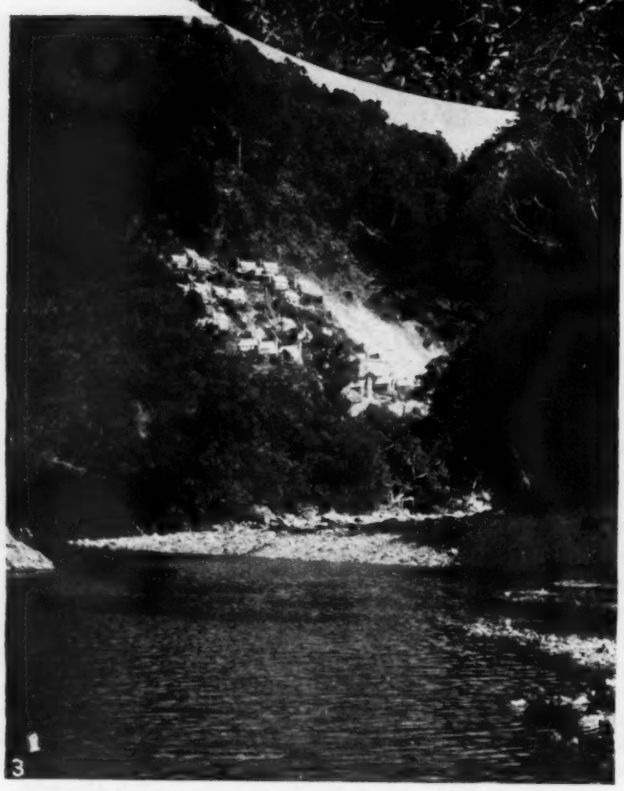

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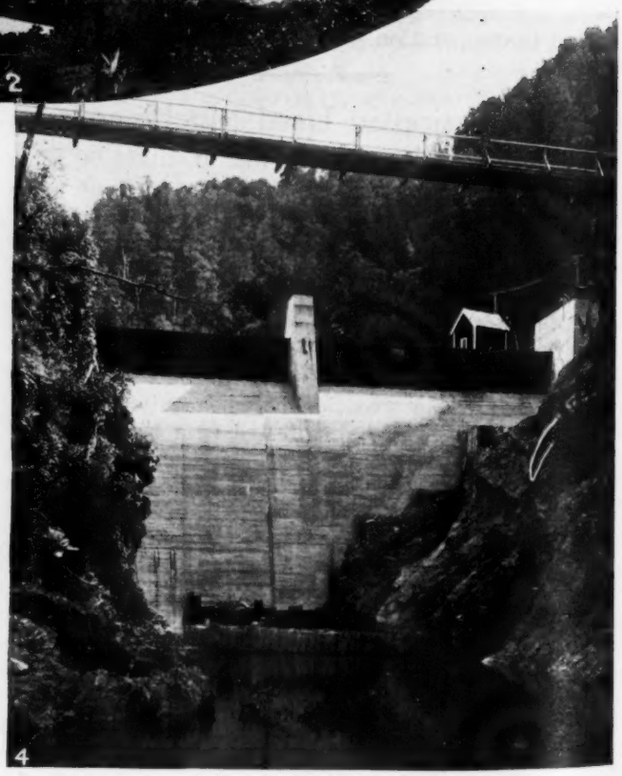

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What "Slacker" Dollars Cost the Industry

"Investment Efficiency" Lags—The Need of Increased Earnings Through Load-Factor Improvement and Especially by Development of the Residence Market

By A. K. BAYLOR
General Electric Company

THE capital investment in electric light and power companies as an average throughout the industry is idle more than half the time.

Load factor is perhaps the leading problem in all modern business, involving as it does the struggle to approach the condition under which all facilities would be profitably at work every hour of the day and night.

When an industry has to do with direct service, involving also drastic variables, such as the weather, the seasons or the tastes, habits and whims of the public, it cannot arbitrarily regulate its output and must depend, in leveling the load, upon an organization of service and scale of charges that will coax the customer, in self-interest, to avoid congested "peaks" and seek the "valley" hours. Such a business is electric power supply.

INVESTMENT EFFICIENCY LAGS

Except for battery charging and water heating, the product of the "power manufacturer" cannot be stored for future use, but must be on tap for supply to every customer at the instant and in the quantity of his choosing, from the switching in of a tiny lamp to the shock of a great rolling mill suddenly thrown on the line. No business, however, is so fortunately placed in variety and scope of markets, for it follows the public around the clock.

During its comparatively short life this industry has shown remarkable—in fact, revolutionary—progress in methods and practices of financing, engineering, management and general operation; but "investment efficiency" has lagged. Load-factor improvement has not kept pace with other elements in the growth of the industry. Energetic full-time and overtime devotion to work is characteristic of the workers from highest official to humblest employee, and yet the dollar invested continues to take it easy—indeed, to "loaf" on the job.

This is due, no doubt, principally to the fact that the possibilities of electrical development have been—and still are—a mine of such abundance that the mere taking off of upper crusts has been profitable. Demand has come spontaneously and oftentimes in volume, in character or at a time embarrassing to the power company. The so-called uncontrollable growth has dominated the situation, but greater interest is now being shown in critical study of controllable demand in its bearing on load factor.

The importance of this question has been especially emphasized in the minds of responsible power company officials, as well as in the minds of bankers and others interested in electrical utility securities, by the widespread application of customer ownership and the extent to which the public generally has voluntarily followed electrical utility securities in the stock market. In the light of past experience and the almost limitless possibilities of future development, it may be confidently assumed that these security values will increase in the long run, disregarding periodical speculative fluctuations, and in such stabilization of values is involved a widespread public good will toward the industry.

Last year the gross return to power companies on more than seven billion dollars invested was approximately $1,500,000,000. It is estimated that approximately $400,000,000 of this total revenue—or more than 25 per cent—came from the 14,500,000 domestic customers. Therefore, roughly speaking, at least 25 per cent of the total investment, or about $1,750,000,000, may be considered as dedicated to domestic service.

In spite of the rapid increase in the number of homes connected, the average service investment per domestic customer has risen substantially in recent years. Domestic load is the most rapidly increasing class of business, nearly one-half the increase in gross during the last five years coming from this source, and it should be the most profitable. Generally, however, it is not the most profitable, although its rate is the highest, but is very often the least profitable because of its low load factor.

LOAD-FACTOR IMPROVEMENT

Average domestic lighting alone has a load factor at the customer's meter of little better than 10 per cent, which may be raised to 13 or 14 per cent by more modern lighting and the introduction of various appliances in common use but with low and intermittent energy demand. We may look forward in the not distant future to the general introduction of radio receiving sets energized from the line, with a demand of approximately 200 watts and a usage of approximately 100 kw.-hr. per annum. The addition of an electric range will nearly double the present average domestic consumption and load factor. If we add also the electric refrigerator, a load factor of nearly 30 per cent may be realized. Include now the water heater, and the amplified domestic service should show a consumption five times the present average at a load factor of 50 per cent or better.

It cannot be expected that all possible conveniences will be installed in every home in the very near future. It does appear practicable, however, with the great diversity of useful appliances on the market, to more than double the present averages in a comparatively short time. With 25 per cent of the total investment, or approximately $1,750,000,000, dedicated to domestic service, therefore, the result of doubling load factor would be to double the earning power of this particular investment, adding, in effect, this considerable sum for revenue purposes without any substantial increase in the investment burden.

Naturally this question is attracting the attention of the financing interests. No executive, it may be assumed, will deny the importance of the issue, and he who wants action should push the button and call for

his commercial manager. If this functionary is not familiar with adaptable means to the desired end—means that have been and are being made available through the published activities of the N.E.L.A. Commercial Section and other channels—then a lost opportunity is emphasized and the need for commercial officials of experience, vision and vice-presidential caliber becomes even more apparent. Such men could point out the potentialities for gain in every class of demand, especially domestic.

Stability of Residence Load

Domestic service is the most stable of demands, riding through industrial depression with remarkable persistence. The problem of developing this demand must of course be considered, in each case, in the light of local conditions and rates, and the building up of any demand with reference to other classes—that is, the average load factor of the system as a whole. It appears, however, that domestic service, although offering the best immediate opportunity for improvement specifically as a class, also lends itself to diversity in relation to other demands and station peaks. Even the electric range has been found to have a wide diversity, contrary to general expectation in its pioneering days. The refrigerator is another potent factor, as is, also, the little understood possibility of water heating, which is peculiarly susceptible of offpeak application through the use of insulated storage tanks.

No new inventive or technical development need be invoked. Reliable apparatus and appliances are on the market, and records of promotional methods, tried and proved, are available to all who will but study and use them.

Under any effort to serve the home fully there must be a foundation of adequate wiring. The building of a new house without wiring and within reasonable reach of electric service is now almost unknown, and it has been found comparatively easy, with the aid of time payment terms, to connect old houses not previously served and to equip them with adequate wiring.

During the last four or five years the standards of wiring have steadily increased in all new installations, but homes that were connected before the need of ample wiring provisions was so generally recognized have insufficient capacity of circuits and an almost complete lack of convenience outlets. Such conditions apply to nearly half the present total homes connected, and obviously domestic service cannot be developed through these millions of restricted outlets.

Here is a condition that the power company cannot, or should not, tolerate and its correction is one of the most serious problems of the industry. The work of bringing old installations up to modern standards does not offer an attractive field for the contractor, even at costs that discourage the customer. Possibly it will be found expedient in the long run for power companies to subsidize both contractor and customer in order to remove the handicap.

Recent analysis of 300 representative communities showed an average annual domestic usage of about 360 kw.-hr., but there are many individual instances with such a consumption per month. Such a difference is too great to be disregarded, especially as these high spots are not exhibition installations, but the homes of families of quite moderate means, in which the advantages of electric service have been intelligently studied and economically applied. What an opportunity for even a slight average increase multiplied by the mighty factor of 14,500,000 homes connected!

Electric service has become one of the first of human necessities. Its advance to this degree of importance and consequent popularity emphasizes the duty of the industry to provide the greatest possible service to the greatest number, and this involves rate scales that will stimulate all possible growth warranted by reasonable return, without which there can be no service. Concurrently, costs must be analytically studied in their bearing on the problem of load factor—a phase heretofore too much neglected and in which the engineering and commercial departments meet.

It is not necessary, however, to consider such a development from the point of view only of altruistic duty. Along the same line of policy lie the assured continuance of public support and improvement in "investment efficiency" that will substantially increase both the income and earnings of the industry.

Electric Drive Applied to Movable Theater Stages

Electrically Operated Screws Chosen Over the Hydraulic Lift to Raise and Lower Orchestra Platform and Organ Console in Moving Picture Theater

By James T. Holmes, C. A. Sanborn and L. A. Irwin
Los Angeles, Cal.*

THE first successful attempt at applying electric drive to a movable theater stage is the installation at Grauman's Metropolitan Theater in Los Angeles. Heretofore hydraulic equipment has been used exclusively for such purposes. In the Metropolitan Theater, a $4,000,000 picture show house, it was the desire of the owner that both the organ console and the orchestra platform be arranged for raising and lowering. Each was to be equipped with push-button control, similar to that used on automatic elevators, to enable the organist or the orchestra leader to raise or lower the platforms at will.

It was also desired that the platform supporting the orchestra be of sufficient size and capacity to raise a 100-piece orchestra together with its equipment. It was desired that the musicians should take their positions on the platform through two doors below the stage, and by means of selective push-button control be raised to a position level with the main stage floor, or either of two intermediate positions, stopping automatically, the control being either from the platform itself or from the main switchboard in the stage wing.

Holmes & Sanborn, consulting engineers, were retained to design this equipment, and the Baker Iron Works of Los Angeles was chosen to manufacture and install it. Careful consideration of several methods of lifting the platforms led to the adoption of screws. It was necessary to consider that the operation of these platforms must be noiseless, and when left in any one position that they remain indefinitely without creeping. It was also particularly desired that the orchestra platform be exactly level with the main stage when in its uppermost position to permit of dancing acts, etc.

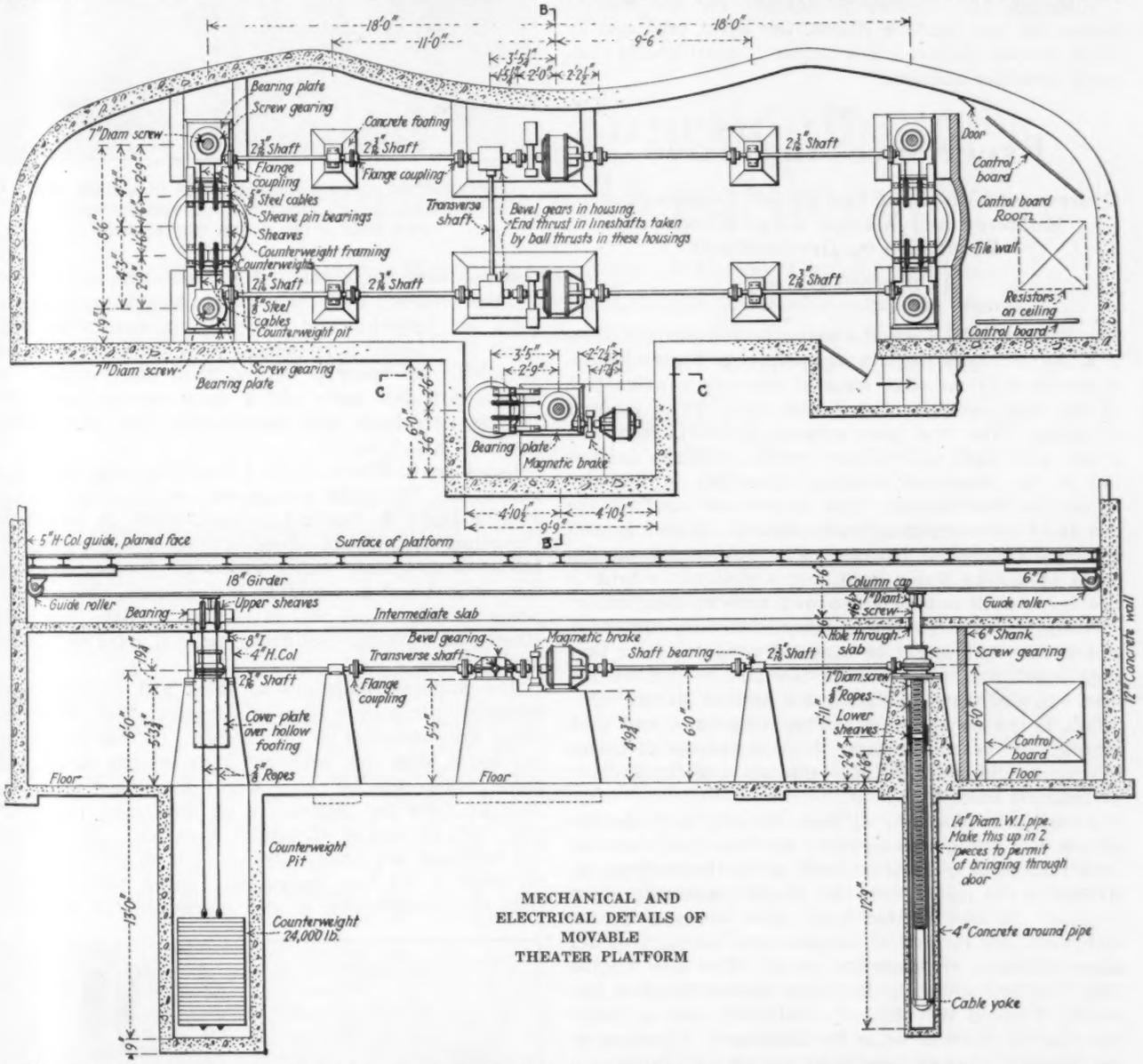
It was thought that, with careful workmanship,

*James T. Holmes and C. A. Sanborn, of Holmes & Sanborn, consulting engineers, Los Angeles, Cal., and L. A. Irwin, of Baker Iron Works, Los Angeles, Cal.

screws and gears could be so accurately cut that when immersed in oil they would run with satisfactory quietness. It was appreciated that the screw lift would not be subject to stretching ropes or leaking valves, and in addition possessed many other advantages. The installation as made has fully met all requirements and has been in satisfactory and successful operation for three years.

Details of the mechanical equipment are shown herewith. The screw under the organ console is raised by means of a bronze nut in a cast-iron housing. This nut has bolted to its outer flange a standard Timken worm ring-gear, as used in a 3½-ton truck axle. The nut is provided with a special ball thrust-bearing at top and bottom. The entire unit is in a cast-iron housing and operates in oil. The four screws under the orchestra platform are similar to the one under the organ console. The worm shafts of the four screw units under the main platform are all mechanically connected together by means of two parallel shafts and two sets of beveled gears. A 25-hp. motor is located about half way between each pair of screw units. A transverse shaft permanently connects the two motors through beveled gears so that the motors operate as a unit. The whole arrangement constitutes a mechanical interlock among the four screws, preventing any possibility of variation in speed.

The motors are special four-speed, direct-current, 230-volt motors, operated by means of push-button and contactor panels. A 10-hp. motor of the same design was used for the organ console. The push-button control box on the organ console has the following controls: concert position, orchestra position, down, fast, slow and stop. For the orchestra platform the controls provided were: stage position, concert position, orchestra position, down, fast speed, medium speed, slow speed and stop.



MECHANICAL AND ELECTRICAL DETAILS OF MOVABLE THEATER PLATFORM

Each platform has suspended from its under side an H-shaped post that descends into a pit. This post has attached to it the necessary lugs and cams for tripping the selector switches at the various stops or landings. This post also operates a slow-down switch on the main platform switchboard, which is brought into action about 4 or 5 in. before the platform reaches the top or bottom landing. The characteristics of the two large motors are such that the slow-down brings the speed of the motors down to a point where the movement of the platform can hardly be seen. When the platform

reaches the top limit of travel, the post operates a switch that causes the platform to stop exactly level with the main stage floor.

In addition to the slow-down and automatic stop for top and bottom positions of each platform, there is an additional limit switch installed in each pit operated by a cam from the platform. This opens the control circuit and stops the platform in case the automatic stop does not work. There is also a stop button at all push-button stations so that the platforms can be stopped instantly if desired.

Although this theater is famous for its interior decoration and lighting effects, the effect produced by these moving platforms is a matter of considerable comment from the audience.

Experiences in Mexico

Observations of Light and Power Construction in Monterey and Mexico City—Effects of Revolution on Developments

BY BEDFORD J. BROWN
Southern Power Company, Charlotte, N. C.

A SHORT TIME ago the writer toured through Mexico. Although the trip was primarily for my health, it occurred to me that some of the new construction of the light and power companies might be of interest to others. The first town entered, Nuevo-Laredo, had a very good light and railway system, evidently belonging to the American company operating in the city across the Rio Grande. The streets and smells make you think of everything you've heard. Water is still principally supplied by men with goat skins on the backs of donkey water carts, but a steel water tank is now being built to supply the town with running water.

Going on through the country, the telegraph lines look better than might be expected until you hear that they have been rebuilt since the last revolution. A man who had traveled a good deal around Mexico said: "That is the way they do. They tear down and then rebuild." I heard the same thing a number of times, but the notable part is they build up, and the Indians particularly build with skill.

Arriving in Monterey at dusk, the city gave the appearance of being well lighted. On the train I met an American mining engineer and, as is the custom, we strolled in the plaza where the people congregate every evening. It was lighted with some old-type cluster standards and strings of incandescent lamps with arc lamps showing through the trees. The new Casino Club was brilliantly lighted with modern fixtures, but beside it stood the old cathedral with only a feeble incandescent lamp or so at the entrances. Upon entering, there is a single drop light strung with lamp cord at the bottom of each chandelier hung from the ceiling. These large chandeliers filled with innumerable candles are still used for the main illumination.

Walking through the streets, we found most of the stores up to date with well-lighted windows. Many of the windows had been built or cut in old thick walls. The city of Monterey suffered much in the revolution, but the people seemed in no way discouraged and had rebuilt rapidly.

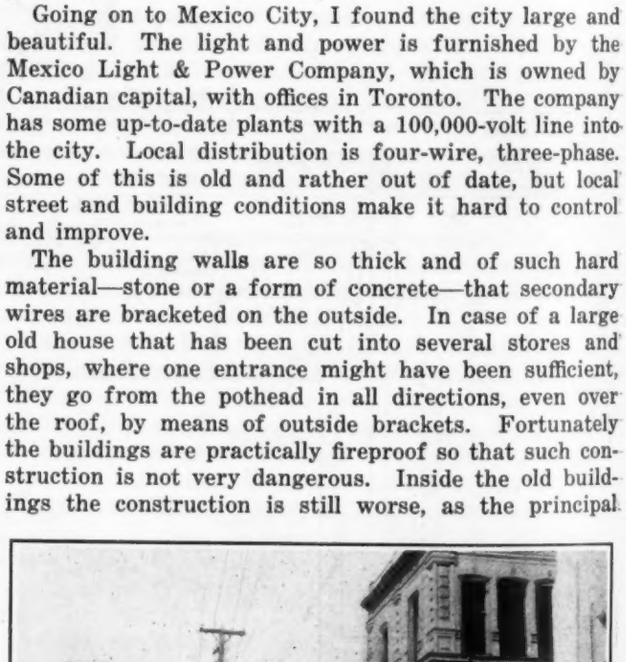
While there I had the pleasure of meeting several of the officials of the Monterey Railway, Light & Power Company. The superintendent, who was an American,

DISTRIBUTION AND TELEPHONE LINES IN MEXICO CITY. THE TALL PIPE AT THE LEFT OF THE DISTRIBUTION POLE IS FOR SEWER VENTILATION

took me over the plant and showed some of the construction work. The company has an oil-burning plant with one 2,000-hp. and four 500-hp. generators with about 3,000 boiler horsepower. New boilers were being installed. As water is very difficult and expensive to obtain, artesian wells and a spray system are used. Distribution lines and construction are particularly good.

Going on to Mexico City, I found the city large and beautiful. The light and power is furnished by the Mexico Light & Power Company, which is owned by Canadian capital, with offices in Toronto. The company has some up-to-date plants with a 100,000-volt line into the city. Local distribution is four-wire, three-phase. Some of this is old and rather out of date, but local street and building conditions make it hard to control and improve.

The building walls are so thick and of such hard material—stone or a form of concrete—that secondary wires are bracketed on the outside. In case of a large old house that has been cut into several stores and shops, where one entrance might have been sufficient, they go from the pothead in all directions, even over the roof, by means of outside brackets. Fortunately the buildings are practically fireproof so that such construction is not very dangerous. Inside the old buildings the construction is still worse, as the principal



TRANSFORMER AND LINE CONSTRUCTION IN MEXICO CITY, WITH SOME RUINS LEFT BY VILLA SHOWN AT THE LEFT

form of wiring used in the old buildings is a kind of lamp cord on round knobs.

The circuits for each district are brought into a small round sheet-iron case or house built in the street, with switches and fuses several feet above the ground level. This was formerly necessary, as the city was often flooded by heavy rains, but now the drainage is so good that this construction is not necessary.

Most of the substations are of the indoor type with the railway machines in them. One outdoor substation has been built and has proved satisfactory, hence all new ones will be of the outdoor type.

The city is well lighted. The main streets, avenues and plaza have good illumination generally, not brilliant or glaring. Old fixtures have five lights, but the new ones have one of modern type. On some of the wider avenues a row of lights is used in the center, and the Paseo de la Reforma has three rows, one on each side and one in the center.

The churches and cathedrals, though they are very brilliantly frescoed in gold and brilliant colors, are very poorly lighted. Some are equipped for special lighting on special occasions. This is cheap looking temporary construction and the lights are apparently arranged for show and brilliant effect rather than artistic illumination.

Organization and Functioning of a Modern Meter Department

Relations of Electric Meter Department of Union Gas & Electric Company to Other Departments, Executives and Customers—Purposes—Division and Co-ordination of Duties—Methods of Handling Duties — Records and How They Fit Into Chain of Operation

By R. C. FRYER* and S. ARONOFF†
Union Gas & Electric Company, Cincinnati, Ohio

IF ANY interest of particular value attaches to the meter department organization and record system of the Union Gas & Electric Company, it is not because the department is large, compared with others in the industry, nor because the system is ultra-complete. On the contrary, it may be regarded by some as lacking in refinements. It is difficult directly to compare organizations of meter departments in various utilities, since many factors contribute in deciding whether a given form of organization is desirable or undesirable. Aside from the number of customers (hence number of meters), quite commonly a basis for comparison, the following factors are vital and decisive —namely, form of company organization, saturation of territory served, relation of meter department to other departments such as billing, accounting, complaint, distribution and commercial departments, methods of service and meter installation, methods of maintaining engineering laboratory and the relation to meter department, and knowledge of meter department problems by superior executives of the utility.

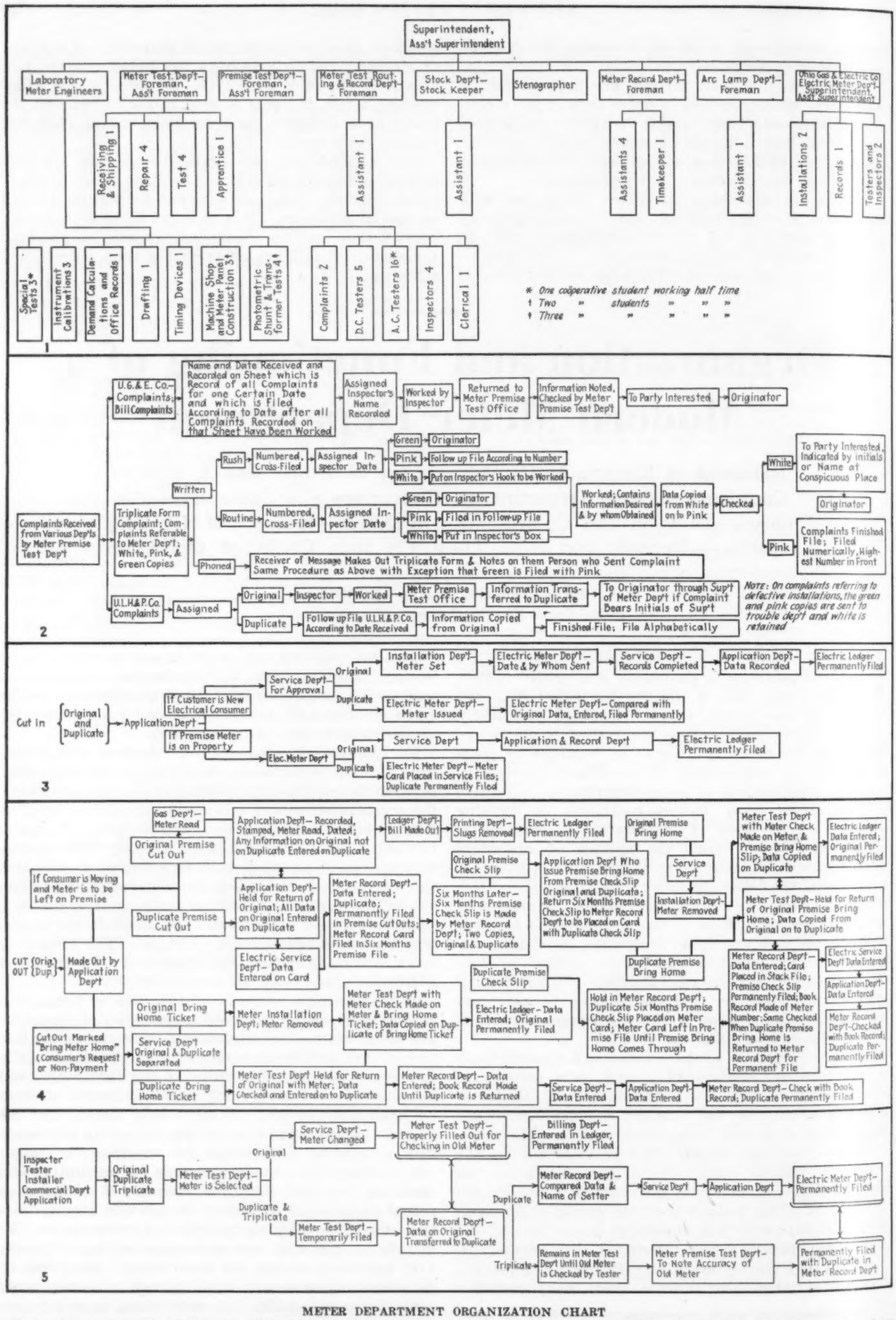
In the organization of the Union Gas & Electric Company, the meter department constitutes a division of the distribution department, of which F. R. Healey is superintendent. He was formerly a meter department executive and is well acquainted with problems pertaining to that department. This organization line has lent itself well to economy through such practices as the installation of meters by the same crew that installs the service. This method has been employed for some time, and with a certain amount of supervision by the meter department has been satisfactory to all concerned.

Aside from the duties which its name implies, the meter department also clears a great many customer complaints, even though these do not involve tests on meters. Besides, tape, oil, insulators, street-lighting units, wire, insulation, instrument transformers and so forth are regularly tested in the meter laboratory for various departments of the company.

For the efficient, economic and expedient administration of this department, involving interrelationship between its individuals, and other groups of individuals, the organization and records had to be worked out carefully to afford both accuracy and simplicity. To maintain satisfactory operation on more than 130,000 meters on consumers' premises and all equipment attendant thereto required subdividing the meter department into subsidiary departments, which with their duties and relations to other departments are shown in the accompanying organization chart (Fig. 1). The total floor space occupied by the department is approximately 37,000 sq.ft., and there are seventy employees.

In general, the purposes of the various forms and records used are to (1) record acceptability of apparatus and equipment; (2) maintain an easily accessible history of the performance of metering apparatus while in service; (3) furnish a record of the distribution and location of apparatus; (4) maintain a record of stock on hand and outside; (5) provide a method for the issuance of stock and instruments indicating the necessary accounting information for charging the same; (6) maintain the necessary records for accounting and charging time and cost; (7) maintain a comparative record on personal efficiency; (8) provide a recapitulation of records enabling analysis and comparisons; (9) provide an economic and systematic routing of work; (10) provide a résumé, for departmental executives, of the general progress of work in each subdepartment; (11) fix responsibility for work done, showing procedure and results; (12) establish a future guide on the

*Superintendent of meter department.
†Assistant meter and laboratory engineer.


Superintendent, Ass't Superintendent
Laboratory Meter Engineers
Meter Test Dep't–Foreman, Ass't Foreman
Premise Test Dep't–Foreman, Ass't Foreman
Meter Test Routing & Record Dep't–Foreman
Stock Dep't–Stock Keeper
Stenographer
Meter Record Dep't–Foreman
Arc Lamp Dep't–Foreman
Ohio Gas & Electric Co Electric Meter Dep't–Superintendent, Asst Superintendent
Receiving & Shipping 1
Repair 4
Test 4
Apprentice 1
Assistant 1
Assistant 1
Assistants 4
Timekeeper 1
Assistant 1
Installations 2
Records 1
Testers and Inspectors 2
Special Tests 3*
Instrument Calibrations 3
Demand Calculations and Office Records 1
Drafting 1
Timing Devices 1
Machine Shop and Meter Panel Construction 3†
Photometric Shunt & Transformer Tests 4‡
Complaints 2
D.C. Testers 5
A.C. Testers 16*
Inspectors 4
Clerical 1
* One cooperative student working half time
† Two " students " " "
‡ Three " " " " "
1
Complaints Received from Various Dep'ts by Meter Premise Test Dep't
U.G.&E. Co.–Complaints, Bill Complaints
Name and Date Received and Recorded on Sheet which is Record of all Complaints for one Certain Date and which is Filed According to Date after all Complaints Recorded on that Sheet Have Been Worked
Assigned Inspector's Name Recorded
Worked by Inspector
Returned to Meter Premise Test Office
Information Noted, Checked by Meter Premise Test Dep't
To Party Interested
Originator
Triplicate Form Complaint; Complaints Referable to Meter Dep't; White, Pink, & Green Copies
Written
Rush
Numbered, Cross-Filed
Assigned Inspector Date
Green
Originator
Pink
Follow up File According to Number
White
Put on Inspector's Hook to be Worked
Routine
Numbered, Cross-Filed
Assigned Inspector Date
Green
Originator
Pink
Filed in Follow-up File
White
Put in Inspector's Box
Worked; Contains Information Desired & by whom Obtained
Data Copied from White on to Pink
Checked
White
To Party Interested, Indicated by initials or Name at Conspicuous Place
Originator
Pink
Complaints Finished File; Filed Numerically, Highest Number in Front
Phoned
Receiver of Message Makes Out Triplicate Form & Notes on them Person who Sent Complaint Same Procedure as Above with Exception that Green is Filed with Pink
U.L.H.&P.Co. Complaints
Assigned
Original
Inspector
Worked
Meter Premise Test Office
Information Transferred to Duplicate
To Originator through Sup't of Meter Dep't if Complaint Bears Initials of Sup't
Duplicate
Follow up File U.L.H.&P.Co. According to Date Received
Information Copied from Original
Finished File; File Alphabetically
NOTE: On complaints referring to defective installations, the green and pink copies are sent to trouble dep't and white is retained
2
Cut In
Original and Duplicate
Application Dep't–
If Customer is New Electrical Consumer
Service Dept–For Approval
Original
Duplicate
Installation Dep't–Meter Set
Electric Meter Dep't–Date & by Whom Sent
Service Dept–Records Completed
Application Dept–Data Recorded
Electric Ledger Permanently Filed
Electric Meter Dep't–Meter Issued
Electric Meter Dep't–Compared with Original Data, Entered, Filed Permanently
If Premise Meter is on Property
Elec. Meter Dep't
Original
Duplicate
Service Dept
Application & Record Dept
Electric Ledger Permanently Filed
Electric Meter Dep't–Meter Card Placed in Service Files; Duplicate Permanently Filed
3
Gas Dept–Meter Read
Original Premise Cut Out
Application Dept–Recorded, Stamped, Meter Read, Dated; Any Information on Original not on Duplicate Entered on Duplicate
Ledger Dep't–Bill Made Out
Printing Dept–Slugs Removed
Electric Ledger Permanently Filed
Original Premise Bring Home
Meter Test Dept with Meter Check Made on Meter & Premise Bring Home Slip; Data Copied on Duplicate
Electric Ledger Data Entered; Original Permanently Filed
If Consumer is Moving and Meter is to be Left on Premise
Duplicate Premise Cut Out
Application Dept–Held for Return of Original; All Data on Original Entered on Duplicate
Meter Record Dept–Data Entered; Duplicate; Permanently Filed in Premise Cut Outs; Meter Record Card Filed in Six Months Premise File
Original Premise Check Slip
Six Months Later–Six Months Premise Check Slip is Made by Meter Record Dep't; Two Copies, Original & Duplicate
Application Dept Who Issue Premise Bring Home From Premise Check Slip Original and Duplicate; Return Six Months Premise Check Slip to Meter Record Dep't to be Placed on Card with Duplicate Check Slip
Service Dept
Installation Dept–Meter Removed
Meter Test Dept–Held for Return of Original Premise Bring Home; Data Copied From Original on to Duplicate
CUT (Orig.) OUT (Dup.)
Made Out by Application Dept
Electric Service Dep't–Data Entered on Card
Duplicate Premise Bring Home
Meter Record Dept–Data Entered; Card Placed in Stack File; Premise Check Slip Permanently Filed; Book Record Made of Meter Number; Same Checked When Duplicate Premise Bring Home is Returned to Meter Record Dept for Permanent File
Electric Service Dep't Data Entered
Application Dept–Data Entered
Meter Record Dept–Checked with Book Record; Duplicate Permanently Filed
Duplicate Premise Check Slip
Original Bring Home Ticket
Meter Installation Dept; Meter Removed
Meter Test Dept with Meter Check Made on Meter & Bring Home Ticket; Data Copied on Duplicate of Bring Home Ticket
Electric Ledger–Data Entered; Original Permanently Filed
Hold in Meter Record Dept; Duplicate Six Months Premise Check Slip Placed on Meter Card; Meter Card Left in Premise File Until Premise Bring Home Comes Through
Cut Out Marked "Bring Meter Home" (Consumer's Request or Non-Payment)
Service Dept Original & Duplicate Separated
Duplicate Bring Home Ticket
Meter Test Dept Held for Return of Original with Meter; Data Checked and Entered on to Duplicate
Meter Record Dept–Data Entered; Book Record Made Until Duplicate is Returned
Service Dept–Data Entered
Application Dept–Data Entered
Meter Record Dept–Check with Book Record; Duplicate Permanently Filed
4
Inspector Tester Installer Commercial Dep't Application
Original Duplicate Triplicate
Meter Test Dept–Meter is Selected
Original
Service Dept–Meter Changed
Meter Test Dept–Properly Filled Out for Checking in Old Meter
Billing Dept–Entered in Ledger, Permanently Filed
Duplicate & Triplicate
Meter Test Dept–Temporarily Filed
Meter Record Dept–Data on Original Transferred to Duplicate
Duplicate
Meter Record Dept–Compared Data & Name of Setter
Service Dept
Application Dept
Electric Meter Dept–Permanently Filed
Triplicate
Remains in Meter Test Dept Until Old Meter is Checked by Tester
Meter Premise Test Dept–To Note Accuracy of Old Meter
Permanently Filed with Duplicate in Meter Record Dept
5

METER DEPARTMENT ORGANIZATION CHART

Fig. 1. Division and co-ordination of duties of meter department.
Fig. 2. Route of complaints referable to electric meter department.
Fig. 3. Route of authorizations for connecting meters.
Fig. 4. Route of authorizations for cutting out meters from service.
Fig. 5. Route of orders to change electric meters.

basis of past experiences; (13) show condition and history of large consumers' metering; (14) maintain a ready reference of special tests.

During the process of simplification and adaptation of this system great care has been exercised to avoid unnecessary duplication of forms and data and to eliminate as far as possible the work of transferring data from one form to another. The routing of customers' complaints and authorizations for connecting, disconnecting or changing meters are graphically illustrated in the flow line charts of Figs. 2, 3, 4 and 5.

Handling of inside and outside meter tests, transformer and shunts, instruments and standards, and stocks, will be discussed in the order named.

INSIDE METER TESTS

Tests on New Meters.—To save time this company has adopted the policy of using the manufacturer's numbers for identification of meters rather than renumbering all meters serially. This has proved very successful. Upon receipt of new meters, they are unpacked, examined, and a 5 x 8-in. stock receipt is made out notifying the stock keeper of the receipt thereof. The stock keeper in turn notifies the inside test department, the latter making a record thereof so that it may know the status of meters for testing purposes and meet possible demands. At the proper time the meters are sent to the inside test department for testing, the testers receiving the meters on specially constructed trucks. Instead of the tester making out a separate test slip for each meter which would subsequently require transfer to the meter card, he records the test data directly on the meter record card and fills in the necessary meter data. Upon completion of the test, the meter is placed in the tested meter stock and the meter card sent to the meter-record department for permanent file. Thus the meter-record clerks are spared the work of transferring and filing two cards.

When a cut-in order or a change order is received, the inside meter test department assigns and tags the required meters with a tag, giving the necessary information thereon. The meter is then packed and ready to go out.

Tests on Meters Brought from Premises.—When meters are returned from premises, either on a change order or on complete removal from premises, they are sent directly to the inside meter test department for test, inspection and general repair, if necessary. Upon completion of this work, a record is made on the meter test and repair card referring to removal to customer's premises only and sent to the meter-record department, where the necessary record is made on the meter-record card. This procedure, instead of permitting the tester to make the necessary record on the meter-record card, is necessitated by the adopted policy of not permitting any record to leave the meter-record department after it once arrives there. The meter is then put in the tested meter stock.

OUTSIDE METER TEST

Tests.—Experience has shown that electrical meters should be tested periodically to maintain their accuracy. The frequency of tests depends upon the size of the meter, its importance and the type of service. To do the work most economically and efficiently, the meter testers are divided into specialized groups. For example, there are testers who take care of small alternating-current meters, large alternating-current meters, demand watt-hour meters, small direct-current meters, large direct-current meters, demand meters and so forth. The entire area served by the company is divided into districts, and each tester is given a route for testing in accordance with the scheduled testing period. However, large power meters are assigned to other testers, who are responsible for the accurate performance of these meters and who inspect them at frequent intervals.

The testing routes are made by a routing clerk, who makes out a separate test slip for each meter that is to be tested. These slips are arranged according to certain routes and are given to the foreman of the outside test department. Upon examination and checking, the slips, according to their routes, are allotted to the proper tester and put in their respective mailboxes. Every morning the tester takes out his allotted routes and makes a 4½x8-in. route slip so that the office may continually be acquainted with the whereabouts of each tester. In addition, the testers report by telephone twice daily, giving their location and receiving further instructions.

Upon completion of tests along any route, the test slips with the test data recorded are returned to the foreman of the outside meter test department, who inspects and returns them to the meter-record department. The test slips are numbered serially and the same number is stamped on the meter-record card. In addition, the accuracy of the meter is recorded on the meter-record card. Thus the minimum amount of transference of data is effected and an easy reference of all tests is obtainable.

INSPECTIONS AND SPECIAL TESTS

Inspections.—Inspections are handled in a similar manner to tests. Routes of all inspections are made out by the routing clerk and each inspection is made on a separate inspection slip and allotted to the inspectors by the foreman of the outside test department. After inspections the slips are returned to the records department.

Complaints.—All complaints referrable to the meter department are handled by the outside test department. The complaint slips are referred to this department by any department of the company that is authorized to receive complaints. The foreman of the outside test department refers the respective slips to the man best fitted to take care of the specific complaints, the slips being distributed through the mailboxes, or instructions are given by telephone upon the next call by the particular complaint man. Upon completion of the complaint call, the slips follow the regular route indicated by the complaint routine flow chart (Fig. 2).

Inspections of Large Power Meters.—All inspection slips of large power meters, which are regularly recorded upon inspection by definitely assigned men, are referred to the electric meter laboratory for reference when calculating the demand chart. Inspection reports on type RA demand watt-hour meters are made on 4½x8-in. white slips periodically by outside inspectors. Notices to read large demand meters are made on 3x5-in. white slips; the reports enable determination of causes for unusual deviation from load conditions reported by consumers. The data, if of any importance, are recorded on the demand statement and this accompanies the regular demand slip to the department executive.

Demand Readings.—All readings of demand meters are made by men in the outside test department. The regular reading slips (4½x7¾ in.) are sent to this

department by the billing department in book form arranged by districts, each district being allotted one book. The books are sealed so as to eliminate the possibility of losing slips and to eliminate the work of checking slips in and out. When the readings are recorded, the books are returned to the billing department. In case the reader cannot obtain a reading of any meter on the regular calls, the outside test department foreman issues a follow-up reading slip to obtain the reading at another convenient opportunity.

Overload Notices.—By reason of its character, the outside test department is capable of determining the load on certain distribution transformers. When any of the men in this department detects an overload condition (the rating of the transformers is supplied by the distribution department) he will issue in duplicate a 3x5-in. overload notice slip to the distribution department.

All instrument transformers and shunts are tested in the electric meter laboratory. Upon completion thereof a record is made out by the tester for each transformer or shunt. Then the apparatus with the card is sent to the stockroom, where the stock keeper makes a record thereof and retains the test card so long as the apparatus is in the stockroom. Upon receipt of instructions, such as cut-ins, changes and so forth, the stock keeper issues this equipment and transmits the test cards to the meter-record department, which in turn records the number of the meter with which this apparatus is installed and files the card.

Defective apparatus is brought to the attention of the respective manufacturer by the head of the electric meter laboratory. Only apparatus that has passed acceptance tests is put in stock. Results of tests on instrument transformers made by the electric meter laboratory for other departments of the company are recorded on a separate sheet.

Instruments and Standards

Rotating Standards.—All rotating standards are tested periodically on a definite schedule in the electric meter laboratory. The working standards are tested against a master laboratory standard, the master standards being checked periodically in the precision room against the primary standards. After testing the rotating standards, the checker makes out two cards—the correction and the calibration. The first of these is put in the card holder in the cover of the rotating standard and provides the calibration correction for the particular standard. The other card, which measures 3x5 in., is kept in the laboratory files and provides a history of the operation of the standard and a reference for tests.

Instrument Calibration.—All instruments handled by the electric meter laboratory, including those on definite test schedule from other departments, are allotted a test card, on which are regularly recorded the frequency of the tests and the performance and history of the meter operation.

Instrument Stock and Requisition.—All instruments handled by the electric meter laboratory and for which the laboratory is responsible are provided with two cards for record purposes. One, the instrument stock record (4x5 in.), kept in the laboratory files, gives a permanent record of all the instruments in the laboratory; the other, an instrument requisition card (3x5 in.), used in the instrument room, shows on one side the location of the corresponding instrument. Two files are provided for these cards in the instrument room—one for all instruments in the instrument stockroom and the other for instruments in service. The transference of cards from one file to the other is performed upon issuance or receipt of instruments.

Before issuing an instrument, the man in the instrument stockroom makes out a slip which is signed by the person receiving the instrument and by the executive of the department for authority. Thus the slip indicates authorization for issuance as well as the person receiving the same.

Special Tests.—All special tests, such as comparative tests on meters, transformers, cable, oils, insulators, compounds and batteries, which are made by the electric meter laboratory are presented in regular report forms and bound in standard covers, and are kept in the electric meter laboratory files.

Stock and Record Departments

Requisitions for stock or equipment go to the stock keeper, who numbers each requisition and makes a record thereof. Then the requisition is sent to the purchasing department through the proper department head. Upon the issuance of an order by the purchasing department, the stock keeper receives a copy and is thereby informed that the purchase is authorized and ordered. Upon receipt of stock and after it has passed inspection and approval, the stock keeper notifies the purchasing department. Then he makes a record thereof on cards, one (5½x9 in.) giving a complete record of the stock and the other (3x5 in.) indicating the location of the stock and quantity on hand. If the stock is received by some one other than the stock keeper, the latter is notified by the receiving party by means of a stock receipt slip. Stock is issued from the stockroom only on requisition (4x6 in.).

Time.—Every employee of the electric meter department is provided with a weekly time card (3½x8¼ in.) to be used in connection with the time clock. In addition, every employee records the time that is spent on each charge order. These two records are checked against each other by the timekeeper, who computes the time and cost and makes the necessary transfers to the daily-record and personal-record charge sheets. A monthly time-cost record (8½x14 in.) embracing all labor charges is computed from all the daily charges for that month.

Meter Records.—All meter cut-ins, cut-outs, changes, transformer records, time, costs, tests and so forth are carried to the meter-record department. Because of this fact the department is easily able to make recapitulations of the general progress in the department such as the continuous meter record (8½x14 in.), continuous meter totals (8½x14 in.), daily record of inspection (5x8½ in.) and monthly accuracy records of meters (12x14 in.). The first type of record is made out for each type and make of meter and is kept in a cover in the meter-record department. The second type of record provides for ready recapitulation of meter records. The third shows department heads' progress and conditions encountered. The fourth is compiled from test slips of outside meter testers by the meter-record department, each type and make the meter having a separate sheet.

All functions of this department are so routed and systematized that only seven employees have been found necessary to execute properly all of the duties mentioned as well as to maintain their records and make recapitulations of work.

Making Line Extensions on Rental Basis

Disadvantages of Former Methods Used—Rental Basis Satisfies the Customers, Justifies Company Investment and Encourages the Use of Service

By WALTER P. SCHWABE
President Northern Connecticut Light & Power Company, Thompsonville, Conn.

THE Northern Connecticut Light & Power Company has lately been quite successful in meeting demands for service from farmers and others located beyond its lines through the use of a line rental system. Formerly the practice was to make line extensions not warranted by the available business on a guaranteed revenue amounting to one-third of the cost of the extension for a certain number of years, or else on a cash contribution toward the cost of the extension, providing for a refund for additional business. Both of these plans were usually unfair, either to the customer or to the company. On the gross revenue plan it usually is assumed that the customer will use energy to the amount of the gross revenue required. This is seldom the case, and the customer, therefore, pays more than a fair charge and more than the service is worth to him. On the other hand, at the expiration of the time of the agreement, the company is left with an unprofitable extension on its hands. Where several applicants are involved, the division of the guaranteed gross income among the several applicants is another objectionable feature.

The cash contribution plan or payment of an amount equal to the unwarranted amount of the investment

Examples of Agreements for Line Extensions on Line Rental Plan

THE NORTHERN CONNECTICUT LIGHT & POWER CO.,
15 Central St.,
Thompsonville, Conn. *Agreement No.* 1

Gentlemen: In consideration of the Northern Connecticut Light & Power Company extending its service lines along the highway in the town of Somers, and Enfield from the present residence of Louis A. Gowdy to the present residences of James Loughlin and Frank Lucy, to supply our premises with electric service, the undersigned agree to wire our homes and take electric service on the company's regular terms and conditions, paying therefor the regular published rates, and a further charge of $17.50 per month to cover line cost. This charge to begin as soon as company is ready to furnish service and to be billed to each of the undersigned in the amounts stated below. The undersigned each and severally agree to be responsible for the total monthly charge of $17.50 line charge. This line charge is to be paid in equal amounts by each customer now or in future taking electric service from said extension, but shall not be less than $1.75 per month each for the first ten customers.

Line charges will be refunded annually at the rate of 50 per cent of amount paid for current in excess of $30 per year. The line charge to remain in force until gross annual revenue from line equals one-third the cost of line.

In consideration of the town extending the street-lighting system along said line of extension and installing street lights, not less than one every second pole, the company agrees to reduce the then existing line charge 20 per cent.

Dated....., Conn.,..... 192 .

APPLICANTS

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AMOUNT OF MONTHLY LINE CHARGE

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THE NORTHERN CONNECTICUT LIGHT & POWER CO.,
15 Central St.,
Thompsonville, Conn. *Agreement No.* 2

Gentlemen: In consideration of the Northern Connecticut Light & Power Company extending its electric line from end of present primary at Pole No. 1117 Windsorville Road, Broad Brook, along Windsorville Road to Windsorville Center to residence of Thomas Norton, and along Wapping Road to residence of Mr. Titus, and along Rockville Road to residence of Mr. Proctor, an approximate distance of 5,250 ft., to supply our premises with electric service, the undersigned agree to wire our homes and take electric service on the company's regular terms and conditions, paying therefor the regular published rates, and a further charge of $17 per month to cover line rental charge. This charge to begin as soon as the company is ready to furnish service and to be billed to each of the undersigned in the amounts stated below. The undersigned each and severally agree to be responsible for the total monthly charge of $17 line rental.

Line charges will be refunded annually at the rate of 50 per cent of amount paid for current in excess of $25 per year. The line charge to remain in force until gross annual revenue from line equals one-third of the cost of the line.

Dated at..... Conn..... 1925.

APPLICANTS

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AMOUNT OF MONTHLY LINE RENTAL

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relieves the company only of interest charges and does not allow anything for depreciation, taxes and additional maintenance, and the applicants usually think this plan unfair, as the company owns the property for which they have paid.

Several years ago we had an application from thirty-six people in South Windsor, requiring an extension of three miles of line, costing about $6,200, and this led to the making of a line rental plan. The plan is fair in every respect to the company and the customer. It gives the customer service at minimum cost and provides a flexible means of making the investment commensurate with the business warranted from each customer. It is also looked upon by the customer as a charge that enables him to buy electric service in outlying territory at the same rate as is charged in city or town limits, and there is also an incentive to increase the use of electricity, as the line rental charge is automatically reduced as the use of energy exceeds the estimated amount.

Ordinarily, we estimate the gross revenue per customer at $25 a year and are willing to make an investment of $75 for this amount of revenue. Should it cost, say, $160 to serve the customer, we ask for a line rental of 14 per cent on $85 (difference between $160 and $75) as rental charge, payable monthly. This amounts to about one dollar per month in the above case. We also provide that the customer should have the benefit should his annual bill exceed $25, refunding to him one-half of the amount of his bills for energy in excess of the estimated revenue. Thus, should the customer's bill per year be $50 instead of $25, he would be refunded the total amount of his line rental, and if this annual revenue is continued for two consecutive years, the line rental provision becomes void. Provision is also made for reduction of line rental for additional connections, and sometimes for street lights installed.

The accompanying agreements are examples of line extensions made on the line rental plan. The amount of line rental was determined as follows:

Agreement No. 1, covering a line extension of 1.9 miles for seven farms and one school house:

Estimated cost	$2,258.00
Company's investment at $90 per customer	720.00
Unwarranted investment	$1,538.00

Taking 14 per cent for interest, depreciation and taxes on $1,500 gives a line rental of $210 per year, or $17.50 per month. Each of the applicants signed for a line rental of $2.20 per month.

Since this extension was made street lights have been installed, in accordance with our street-lighting contract with the town, and the line rental has been reduced 20 per cent in accordance with the agreement.

Agreement No. 2 covers an extension of about a mile to supply a group of seventeen customers, constituting a farmers' settlement at a crossroads. Owing to the necessity of joint construction with the Postal company, this job was estimated at $2,714.24.

Estimated cost	$2,714.24
Company's investment for seventeen customers at $75 each	1,275.00
Unwarranted investment	$1,439.24

To yield 14 per cent to cover interest, depreciation and taxes required a line rental of $16.79 per month, in even figures $1 per month line rental charge from each of the seventeen customers.

In the last few years we have made, on this line rental plan, more than thirty extensions, varying in length from 500 ft. to several miles, for from one to thirty customers, adding a total of about nineteen miles to our lines, and 145 customers, mostly farmers. Line rentals run all the way from 25 cents per month to $5 per month per customer.

This plan has taken well and is readily accepted when the people are educated to the fact and understand that electric line extensions can be made only on the basis of a fair return to the investors in company securities.

Sign-Lighting Business Untouched

Opportunities Unrealized and Uncapitalized—Essentials to Development—Must Be Sold as Service—Utility's Responsibility

By K. P. GOEWEY
Sales Manager Nebraska Power Company, Omaha, Neb.

AS LESS than 1 per cent of the millions of dollars spent annually for advertising in this country is spent for electric-sign advertising, it is evident that this field has scarcely been scratched. There is a possibility for the sale of 1,000 to 1,800 kw.-hr. per year per commercial customer for electrical advertising. By this I do not mean that every customer would produce that amount of business for the utility, but the average of all signs would amount to this figure when the job is fairly well done.

Failure to use electric-sign advertising more extensively is not the fault of the merchants and dealers, for they have never had its true merits brought forcibly to their attention. Electric-sign advertising will never reach the plane it deserves until merchants are absolutely sold on the fact that it is indispensable to a thriving business and that not only an electric sign but an electric-sign service can be provided by qualified authorities.

Not much enthusiasm is developed by utilities over the results obtained from mere efforts at selling signs, but the company that aggressively sells an electric-sign advertising service finds a profitable load with a very slight increase in the investment and distribution cost.

ELECTRIC SIGN INDISPENSABLE

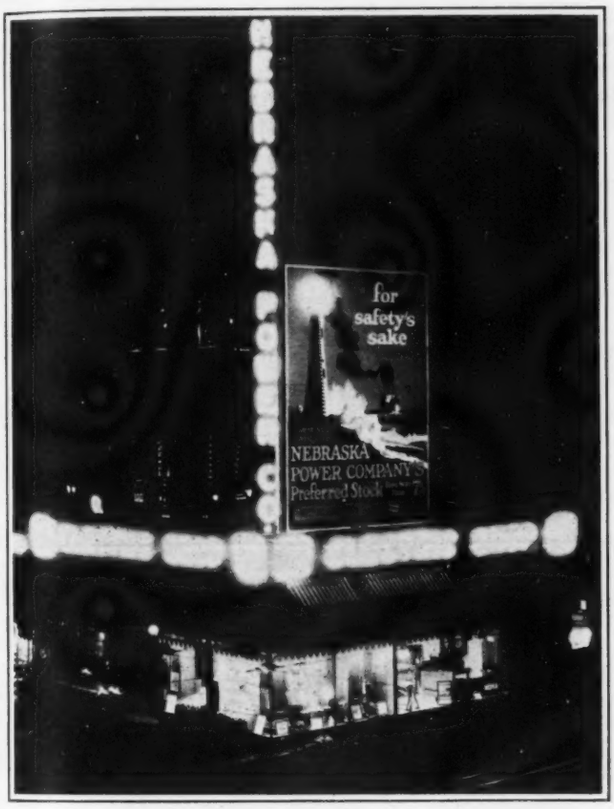
Advertising is accepted as one of the essentials of business development. Electric-sign advertising is an essential part of general advertising and can be made to tie in very effectively with newspaper advertising and produce added benefits from all advertising. Furthermore, electric-sign advertising develops civic prosperity. As evidence of this, compare the relative business conditions in similar towns with and without sign lighting.

Electric-sign advertising is as indispensable as newspaper advertising, clerks and display windows. It attracts not only persons near by but those three or four blocks away. Electric signs work twenty-four hours a day and are on duty whether one hundred or ten thousand people pass. Placed directly upon a merchant's building, the electric sign has the additional advantage of identifying the merchant's business with his location.

Have electric-service utilities been awake to the possibilities of electric-sign business and have they

shouldered the responsibility to develop this form of advertising for their customers?

To foster the electric-sign business, it is absolutely essential to have signs well constructed, well phrased, well lighted and well maintained. Public utilities should not depend on electric-sign companies alone to sell electric signs in their communities. Every public



HOW NEBRASKA POWER COMPANY SETS EXAMPLE IN ELECTRICAL ADVERTISING

utility should have its electric-sign division, headed by a competent salesman who knows the electric-sign business. This expert should devote his entire time both to educational work and to selling. This close co-operation should also exist between the utility company and the electric-sign manufacturer. A definite policy should be adopted by each utility for advising every merchant of the advantages of electric-sign lighting. Furthermore, electric-service companies should practice what they preach and utilize electric-sign advertising.

Electric-sign advertising is a service and should be sold as such. This service should include installation, maintenance, relamping and repainting. The sign itself is simply the medium through which this service is rendered, but careful advice should be given the customer as to size, design, location and the illuminating value as applied to a merchant's building.

Nearly all customers, especially when contemplating the purchase of the first electric sign, are likely to look for a bargain. Ordinarily, when a cheaply constructed sign is purchased, the customer is afterward disappointed both in the sign and in the results. A properly designed and lighted electric sign should not only tell but sell; not merely sell merchandise, but sell the customer into coming into the place of business and making purchases. Too many electric signs carry merely the name of the firm instead of what the firm is selling. People are not so much concerned with the person or firm selling merchandise or service as they are in the particular merchandise or service.

Maintenance, relamping and repainting left in the hands of the customer should be strongly discouraged. The customer is not equipped to do this work and cannot do it as reasonably or as well as the utility maintaining an organization for such work. A sign that contains dead lamps or needs a good coat of paint or cleaning is a detriment to electric-sign advertising.

Electric-sign advertising is the business of the utility, which should eliminate all responsibility from the customer after the sign has been erected. Nightly patrol checks of each sign should be made to record dead lamps and necessary repairs. Maintenance or relamping can be done the following day in order that the customer will not lose any advertising value.

Sign service, including the cost of the sign itself, should be sold on a contract over a period of two to three years. Contracts of this duration reduce the monthly expenditures, which help the merchant in getting started in this line of advertising. In figuring the monthly charge for electric advertising, all expenses applicable to this service should be included. The customer is willing to pay for the service furnished him, and if given proper service, he will be proud of his sign and fully aware of its advertising value. The result will be a stronger booster for electric advertising.

Electric-sign advertising is an exacting service, but with proper organization and a thoroughly worked-out plan, it coincides perfectly with the aim of every utility —perfect service.

Contactor for Breaking High Currents

IN ORDER to insure as far as possible uniformity of design and interchangeability of gear on the new 1,500-volt, direct-current electric freight locomotives of the Paris-Orleans Railroad an electro-pneumatic contactor unit has been built by the Oerlikon Maschinenfabrik which is used not only for the speed-regulating equipment, for switching in and cutting out the starting resistances, but also in conjunction with overload and no-voltage relays for performing the duties of automatic main circuit breakers. These contractors have a one-hour rating of 275 amp. at 1,800 volts with breaks every two minutes for twelve hours. One of these contactors was recently subjected to tests with larger than rated currents at the substation of the Paris-Orleans Railroad at St. Michel sur Orge, in order to collect data regarding its rupturing capacity.

Fifteen switching operations were carried out in all, at a pressure of 1,500 volts, some at intervals of only one minute, the current being increased step by step from 1,000 amp. to 2,300 amp. and the circuit closed and opened with the same contactor. The interruption of current took place in each case with a sharp report. On the other hand, the rupturing arc was relatively small and projected only a little beyond the arc chute, on account of the very energetic blow-out effect. After these tests there were practically no traces of wear or fused metal at the breaking point. It may be of interest to mention that when switching on these currents no arcing could be observed at the point of contact. Seven locomotives equipped with these contactors have already been in service for a considerable time, and the gear in question is reported to have given satisfaction in every respect.

Indiana Experience with Carrier-Current Telephony

High-Frequency Telephony Satisfactorily Replaces Wired Telephone Lines for System Operation Is Experience of Central Indiana Power Corporation

WHAT is believed to be the most extensive application of high-frequency or "carrier-current" telephony over power lines* is operating on the system of the Central Indiana Power Corporation. Seventeen stations are provided with this means of communication for load dispatching and general communication. The system, which has been in operation nearly two years, involves 250-watt, two-way automatic selective sets with phase-to-ground antennæ coupling. The distance between adjacent communicating points ranges from 20 line-miles to 75 line-miles, and the maximum distance of transmission is about 200 line-miles from one side of the system to the other. Approximately 1,000 miles of 132, 66 and 33 kv. transmission line is involved.

According to John Ferguson, vice-president of the company, as many as 400 carrier telephone messages have cleared at the load-dispatching office at Lenore in one day, but subdivision of dispatching has reduced this to 300 messages per day. The total number of load-dispatching messages at all stations for a twelve-month period was in excess of 350,000.

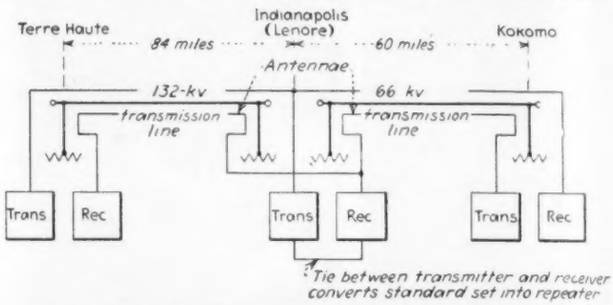
There are only four points at which voltage changes occur in a communication path, but the communication arrangement is such that communication does not have to be maintained through these voltage changes except at one point, where there is a natural inductive coupling between the 66-kv. line and 33-kv. line.

Not much success has been obtained in talking through gaps formed by open oil circuit breakers and disconnects, but the company is fairly satisfied that the problem can be solved. In one 80-mile stretch talking was maintained through one gap, with phase-to-ground antennæ coupling, but the company would not say that it was commercially satisfactory. The closed transmission loops have provided alternative paths for communication.

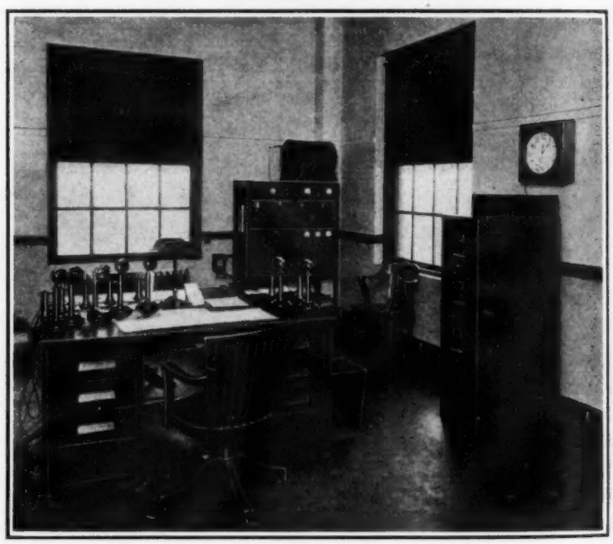
From the standpoint of reliability, it is the company's judgment that carrier communication is superior to the average physical telephone wire lines. On sixteen sets that have been in use for twelve months the total number of defects that affected communication service was 274. In about 80 per cent of these cases, however, the sets remained in operative condition, the failures being only in the receiving selector mechanism, preventing incoming calls being announced, but leaving the apparatus in condition for outgoing calls. The selective ringing feature is considered to be the weakest element, but when the amount of traffic is considered, the percentage of failures to ring the bells is not thought to be high.

One man looked after the sets in the Northern Indiana Power Company's group north of Kokomo, one man in the Wabash Valley district, and one man in the Indianapolis field. These men are drawn from the amateur radio ranks. As the initial difficulties inseparable from all new types of equipment become eliminated and the operation becomes more refined, it is probable that routine inspection and minor maintenance will be placed in the care of the plant operators, with a reduction in operating expense.

The total operating and maintenance cost of seventeen sets for the year ended June 30, 1925, was approximately $8,800, or about $517 per year per set. Of this expense 75 per cent is chargeable to labor and traveling expense and only 25 per cent to material expense. The material maintenance expense has averaged about $130 per set per year. The greatest single item is for vacuum tubes. The expense may become greater over a period of years. Some sets have lost no transmitting tubes during the year and others have lost no receiving tubes. However, it is too early to supply reliable figures



METHOD OF COUPLING TRANSMITTING AND RECEIVING SETS WITH POWER LINES AND BYPASSING LINE VOLTAGE CHANGE



TRANSMITTER IN LOAD DISPATCHER'S OFFICE AT INDIANAPOLIS

The automatic telephone stands on the load dispatcher's desk. The other phones operate over short wire lines to local points in the city of Indianapolis, where there is a steam-generating plant and several substations.

on the average hours of life of tubes. The actual use of the sets is as low as twelve minutes per day, involving 24 messages of 30 seconds duration. The Lenore set, on the other hand, is in use more than four hours daily, the call duration averaging one minute. The 250-watt tubes in this set have given an average life of 1,200 hours, which is higher than the average for any other sets. The results seem to indicate that the length and frequency of the messages have considerable bearing on transmitting tube life.

Receiving tubes must always be kept energized. Some of these tubes are still in service after 12,000 hours' use, and on some of the sets there have been no failures during the year. With the high power employed, the filament current can be kept very low, which undoubt-

*Described in ELECTRICAL WORLD, March 13, 1926.

edly accounts for the long life of these receiving tubes.

One feature which physical telephone wire lines provide and which carrier-current communication has not furnished in an equal degree is the ability of the load dispatcher to keep in constant touch with transmission-line maintenance crews when repair work is being done on a line. The manufacturer offers a portable set for this application, but this is hardly as flexible as could be desired and will probably require further development before it can be considered of great practical value.

The conditions existing on this system were peculiarly favorable from the standpoint of first cost, and these fortuitous conditions may not necessarily apply for every case. The average separation between power plants in this system is about 35 miles. Under these conditions the relative investment cost was found to be in favor of carrier current in the proportion of one to four.

Mr. Ferguson declared that where reliance has to be placed on the one form of communication carrier-current telephony has superior advantages with respect to first cost on 132-kv. transmission lines. Even where a 132-kv. line is of sufficient importance to justify the installation of a separate telephone line on adjoining wooden poles, he believes that carrier equipment may profitably be installed either as reserve or for normal operation.

Inductive-Type Signaling Equipment on Union Pacific Railroad

A STRETCH of 226 miles of double track on the Union Pacific Railroad from Cheyenne, Wyo., to North Platte, Neb., has been electrified for safety control of train movements with a new inductive type of equipment, which is considered a marked improvement over the complete block system now employed by that railroad. According to reports from Cheyenne, a total of 131 locomotives have been equipped to operate in conjunction with the new system. The locomotive equipment includes a 32/350-volt direct-current motor-generator, the current of which is cut down and changed by amplifiers using pliotrons, type PJ2 and PJ4 tubes with a filament voltage of 4.5.

On this particular stretch of track a transmission line parallel with the track is employed. Current is transmitted at 2,300 volts alternating current from the plant of the Cheyenne Light, Fuel & Power Company and the central stations at Kimball, Sidney and North Platte, Neb. Two sets of transformers are employed, the first reducing the voltage to 110 and the latter to 1½ volts and 3½ volts at the rails. The combination of the track current with the current generated in the locomotive operates the control lights in the engine cab—green for "clear" and red for "slow down." When the green is showing, the engine progresses at schedule speed; when red shows, it indicates a train or car on track in the block ahead. A limited time is permitted for the reduction of speed to 20 miles an hour, and if this is not accomplished by the engineer, an automatic application of air to the brakes will result.

Since the new system was first started eight months ago more than 11,000 engine movements have been recorded in the division mentioned without any difficulties being experienced. Equipment used is manufactured by the Union Switch & Signal Company and is of the two-speed continuous inductive type.

Letters from Our Readers

Proper Size of Secondaries

To the Editor of the ELECTRICAL WORLD:

I have just been reading, on page 449 of your issue for Feb. 27, H. S. Litchfield's article on "Economical Wire Size for Lighting Secondaries." Mr. Litchfield has touched upon a very important subject; namely, a careful consideration of all factors involved in choosing the size of copper to be used for any installation. It is the most thorough treatment of this subject that I have seen.

There is one assumption made in this article which seems to me a little different from what would normally be taken; that is, that the load is all concentrated at one point and that the no-load voltage at the lamps is 100 per cent. Would it not be more advisable to do as some companies do and assume that the no-load voltage at the lamps is higher by an amount equal to approximately 50 per cent of the expected regulation for the central point on the secondary?

If the regulator on the primary feeder is then adjusted to give a constant voltage on the secondary, instead of on the primary at the load center, the voltage drop is determined by that permissible for good regulation, and some of the lamps will be operating at slightly higher voltage while others are operating at low voltage.

If we do this, then the average of energy consumption over the total length of secondary will show practically no lost revenue due to reduced lamp voltage. If we do not do this and determine the wire size, or secondary, at the time it is installed, changed conditions which very soon arise will not give us the most economical copper size; then, of course, we must decide whether it is more economical to pay for the slight additional loss or to change to the most economical wire size under the new condition.

Commonwealth Edison Company, Chicago, Ill. TITUS G. LE CLAIR.

Are Starting Compensators Needed?

To the Editor of the ELECTRICAL WORLD,

I was very much interested in reading the instructive article in your issue of Jan. 30, 1926, under the title "Are Starting Compensators Needed?" The data in this article may seem interesting enough to be kept by readers all over the country for reference, and in such case it would be to the best advantage if modifications were made of certain facts set forth which, in my opinion, are misleading unless certain explanations are made.

It should be kept in mind that the squirrel-cage motor circuits consist of two wiring sections—one section from the compensator to the motor itself and the other section from the source of supply, or panelboard, to the compensator. The tests mentioned in this article seem to concern themselves mostly with the section of the wiring from the compensator to the motor, but it seems to me that it is the other section—that is, from the panel to the compensator—with which everybody is concerned in respect to the amount of current passing through these particular wires. It is this second section of wiring which has to be of heavier capacity than that required for the section from the compensator to the

motor to comply with the rules of the National Board of Fire Underwriters. The compensator-to-motor wiring need not be greater than 110 per cent and cannot be greater than 125 per cent of the running current of the motor, as the fuses or relays at the compensator which protect the motor are cut out of circuit during starting. However, the fuses back further on the line at the panel which protect the wires from the panel to the compensator are not cut out of circuit and must remain in circuit during the full starting period. Therefore these fuses must be larger than those at the compensator, and, along with this, the wire which they protect must be larger than the wire actually required between the compensator and motor. This condition would be emphasized if no compensator were used. The amount of saving in money, as stated, when no compensator is used may be misleading. The saving will depend on length of motor circuit and size and voltage of motor, as the change in wire and conduit sizes are not in direct proportion. There will be the additional cost of wiring from panel to starting switch, additional cost of panel-switch size and additional cost of starting switch instead of ordinary unfused switch. In long circuits there will not be much saving; in shorter circuits there will be. These circuits may run from 20 ft. to 150 ft. or more. The saving given in the article—i.e., $55—would, according to my calculations, seem to apply to circuits of 40 ft. to 50 ft.

In the second column on page 252 the statement is made that the motor started without a compensator will take approximately only 20 per cent more current than it would take were a compensator used. This I assume was based on an 80 per cent compensator tap and on the fact that the current in the motor circuit is proportional to the voltage. However, the current in the panel to the compensator portion of the circuit has the advantage of the transformer action in the compensator, and the current in this section is not proportional to the voltage, but to the square of the voltage, which would make the starting current without a compensator approximately 55 per cent more than with a compensator (80 per cent squared equals 64 per cent; 64 per cent + (55 per cent of 64 per cent) = approximately 100 per cent. As the curves shown in the article under discussion seem to be based on this 80 per cent reduction of starting current for compensators, instead of on the actual 64 per cent basis, the data would seem to be of doubtful value. In other words, these curves should be based on the comparative currents in the panel to the compensator section of wiring, as brought out in the first part of this letter.

On column 1 of page 252 it is set forth that in case one of the fuses is blown on the compensator the motor will still start on three phases as these fuses are cut out of circuit on the starting throw, whereas when the switch is thrown over to the running position the motor will be running on single-phase. It is pointed out that this cannot happen when the motor is thrown directly across the line. I cannot quite understand this, as the same thing would hold true, that the fuses at the starting switch would be cut out of circuit during starting, and so the motor could start even though one fuse were blown and would in turn be running on single-phase when the switch was thrown to the running position.

In conclusion, I think it would be most interesting to see a corresponding set of curves based on the current on the panel side of starter. J. W. WERTHER.

New York.

Overmotoring on Polyphase Circuits

To the Editor of the ELECTRICAL WORLD:

Theodore Torda in your Feb. 20 issue, commenting on the writer's letter, "Overmotoring on Polyphase Circuits," published by you on Nov. 21 last, emphasizes the urgency of the demand which is finding expression on all sides today to eliminate the unnecessary compensator and at the same time obtain a motor with sufficient torque and high starting and running power factor, and with the last but not least important characteristic of low starting current.

Articles which have recently appeared in your journal, particularly that by Professor Bailey in your issue of Jan. 30, together with your editorial comment on same, and J. W. Lovell's letter published last week by you, further press the issue. The symposium conducted in the January issue of the *Industrial Engineer* also gave the opinions of many engineers on the relative advantage of using compensators of primary resistance starters, and an editorial asked, "Why Not Take the Shackles Off the Squirrel-Cage Motor?"

Mr. Torda lays down the conditions which should be met in an ideal motor, and although his ideal has not been realized in its details, yet from the commercial standpoint the problem is solved for light duty by the high-resistance secondary motors or the variation of this type, the double-squirrel-cage motor of the Boucherot type.

The double-squirrel cage motor, while giving the necessary torque and limiting the current to just within the N.E.L.A. rules, up to about 20 hp. possesses the grave disadvantage of a very low power factor, and the writer believes that up to 15 hp. or 20 hp. motors of the highly developed, high-resistance, single-squirrel-cage type are commercially preferable as they have the advantage of a power factor 10 per cent higher than that of the double-squirrel-cage type and are simpler and cheaper, the only disadvantage compared with the double-squirrel-cage type being a fractional difference in efficiency, which is more than made up by the very much higher power factor they possess. Above this size the type of motor employing a high-resistance squirrel-cage winding, properly proportioned, in conjunction with a low-resistance phase winding automatically put in circuit when the motor has reached a predetermined speed has proved the best solution which can be found.

The heavy-duty type of self-starting motors with automatic switching have the very important advantage in all sizes that they start up at very high power factor and as the result of this develop about twice the torque per ampere of starting current as compared with the other types. They give, if necessary, a higher torque than the double-squirrel-cage motor, and the current is limited not to come just within the N.E.L.A. rules, but averaging 66 per cent of the rules. When it is considered that these motors are built commercially in sizes up to 125 hp. and up to 2,200 volts, it is evident that they answer in the most admirable way the commercial demand today, and while the writer wishes Mr. Tordà every success in his researches, yet for all practical purposes it is certainly well not to lose sight of the fact that motors commercially meeting the conditions laid down have been manufactured in quantities for many years in this country. F. I. HISS.

Cincinnati, Ohio.

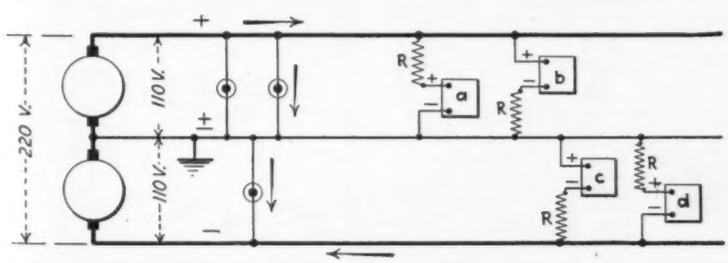
Central Station and Industrial Practice

Charging Storage Batteries from Direct-Current Mains

BY LEO S. LOOMIE
Assistant Electrical Engineer Board of Education, New York City

WHEN direct current is available, it is common practice to charge storage batteries by means of a resistance in series. If the batteries themselves are of low voltage, however, and are used for signaling systems, telephones, etc., trouble has frequently been encountered in the burning out of coils, annunciators, etc., during the charging period due to the improper placing of the resistance. Usually batteries are charged from a circuit one side of which is grounded, but the grounded leg may be positive or negative with respect to the other wire, which means that current may flow toward or away from the ground as indicated in the drawing.

If the circuit is a typical lighting circuit, it is seen at *a* and *c* that the battery may be connected directly to the ground and no trouble need be expected from a high potential. If, however, the resistance is connected to ground, it will be seen at *b* and *d* that the potential of the battery and everything to which it may be connected are raised above the ground potential an amount equal to the drop in the resistance. When batteries are used for telephone systems, usually six volts is required, and cases have come to the writer's attention where persons operating the telephones have experienced quite an electric shock, and elevator signal systems have been rendered inoperative due to the higher potential than that for which they were designed being applied to them, through the improper placing of charging resistances.



LOCATIONS OF CHARGING RESISTANCES WITH RESPECT TO SUPPLY WIRES

Of course the simplest method of avoiding trouble during the charging period is to disconnect the battery from the apparatus to which it is connected. However, the determination of the grounded side of a circuit is an extremely simple matter by means of either a voltmeter or a test lamp and the precaution of connecting the proper terminal of a storage battery to the ground will in many cases avoid the burning out of low voltage apparatus or sometimes dangerous shocks to operators.

Economic Spacing and Size of Substations

IN LAYING out transmission circuits, substations, feeders, sub-primary mains and secondary networks for a metropolitan section in the Middle West, one utility company follows a plan of development which it recognizes as a "far cry" from advocated methods but nevertheless reports that the final results are well within the limits to be expected of any economic theories. The original transmission system between major stations and substations was based on radial feeders out of a common center located near the then system load center. Within the past few years there has been placed in service a 110-kv. ring which completely surrounds the metropolitan area. This ring is well outside the present development area. Consequently, as the city spreads out, the transmission distances between power sources and substations steadily become shorter and of lower cost per unit.

For substations a rating of 12,000 kva. has been established as the maximum, the installation being made of two transformer banks. Each of these banks is directly connected to a 13.2-kv. feeder from the nearest major power source on the high-voltage ring. The high-side automatic switching of these banks is situated at the supply end of these feeders. This is claimed to result in a very low substation investment on the high-voltage side. An emergency feeder is provided for each of the substations, being switched by non-automatic oil switches of limited breaking capacity and resulting moderate cost. The low side of each bank goes to its own bus and group of feeder switches, the two bus sections being tied through a reactor. This permits the use of feeder switches of limited breaking capacity.

All this substation switching is of the automatic reclosing type, and for that reason the substation operating cost does not vary appreciably with the size of the substation. The feeder panels are of the ironclad truck type and therefore represent a fixed unit investment irrespective of size of substation. By using the unit design, the substation cost per unit of output varies over very narrow limits without regard to the size of the substation.

In building the substations the company starts with one bank, a spare unit and emergency cable and one-half of the bus structure. As feeder capacity is required the necessary truck panels are wheeled into position and the required number of automatic regulators set. When the demand justifies the second bank, the other half of the bus structure is installed, two additional transformers are added to the existing spare to make up two complete banks, and the third high-tension feeder is installed. Under this plan the cost per unit of output can be maintained at nearly a constant figure.

When feeders are installed, they are run between the substations and a normally open emergency switch is

installed at an intermediate point. When the district develops beyond the ultimate capacity of both substations, the first half of a third substation is installed at some intermediate point. In this way substations are developed in steps of 6,000 kva. A feeder carried out of the third substation is connected directly to the center of the existing pair of feeders already in position between the original pair of substations, so that the new feeder investment represents a very minor value. The original breakdown emergency switch is then removed and two new ones installed midway between the new substation and each of the original ones.

Naturally the sub-primary mains and branches, together with distribution transformers and secondary mains, do not change with this rearrangement. As a result of this policy of development it is never necessary to retire or write off any appreciable part of the original investment.

In the development of secondary networks very much the same idea is carried out. The secondary network is established on a permanent basis when the district first opens up. As demand increases, the transformers are increased in size up to an established maximum size. When this stage is reached, further growth is taken care of by placing more transformers at closer intervals.

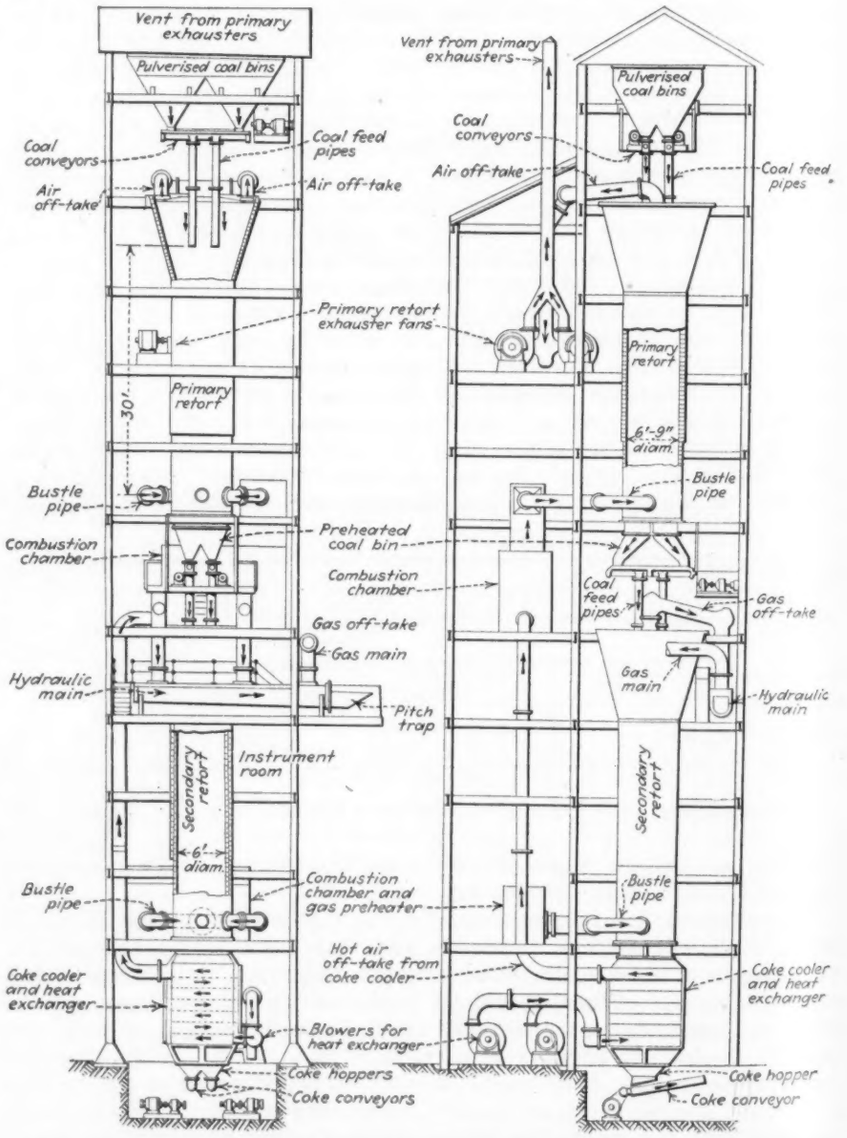
Byproduct Processing of Coal for Utilities

ANNOUNCEMENT has recently been made of the installation of a 200-ton McEwen-Runge commercial-scale experimental retort for low-temperature carbonization of coal by means of flue or re-run gases at the plant of the Milwaukee Electric Railway & Light Company. It is interesting as indicating a step toward byproduct processing of coal so that the valuable byproducts may be used or sold and the remaining powdered semi-coke used for firing utility boilers in the production of electrical energy.

According to H. W. Brooks, consulting engineer of the Fuller-Lehigh Company, low-temperature carbonization of coal offers one of the outstanding opportunities for a large reduction in fuel costs of power plants by permitting the recovery and saving of byproducts which will cover the cost of processing and leave a better fuel for power-plant operation. Every year there is consumed in the United States alone, declares Mr. Brooks, nearly a half billion tons of coal containing economically recoverable primary byproducts considerably more valuable than the average gold content of quartz from the largest gold mine in the United States.

The operation of the Milwaukee installation is illustrated in the accompanying drawing. It utilizes the principle of carbonization of pulverized coal in suspension by means of flue or re-run gases. Powdered raw coal is dropped into an internally heated tower where it will come in contact with an upward current of hot inert gas. The extremely large surface presented by the finely divided fuel particles insures a rapid transfer of heat so that distillation is effected during the time the fuel falls from the top to the bottom of the tower, a distance of approximately 30 ft.

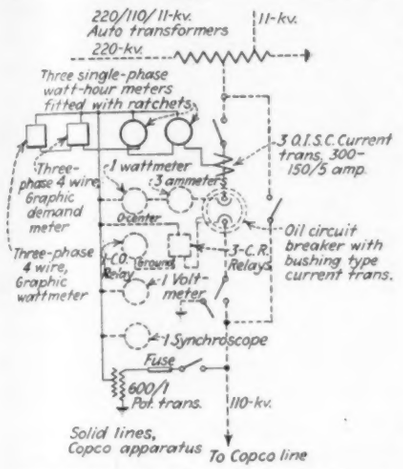
When using coal having a tendency to agglomerate, advantage is taken of the fact that by preheating the coal to an average temperature of 600 deg. F. the coking tendencies of the particles are destroyed. It is then passed through another tower, immediately beneath the first one, where the remainder of the volatile matter is distilled by passage through a counter-current of gas at an average temperature of 1,050 deg. F. The gases and oil vapors are carried off to scrubbing and cleaning apparatus, and the pulverized semi-coke is conveyed from the bottom to be burned under boilers in pulverized form.



MILWAUKEE EXPERIMENTAL INSTALLATION FOR RECOVERY OF COAL BYPRODUCTS AND PRODUCTION OF FUEL FOR POWER-PLANT COMBUSTION

Six Single-Phase Watt-Hour Meters Measure Power Interchange

BECAUSE of the greater reliability of three single-phase meters over one three-phase meter, the California Oregon Power Company uses the former arrangement for metering the power interchanged



EXCHANGE POWER METERING SCHEME

Connections for six single-phase watt-hour meters for measuring power interchange between the California Oregon Power Company and the Pacific Gas & Electric Company at Cottonwood, Cal.

with other systems at points of interconnection. In cases where power can flow either way it is necessary to use six single-phase watt-hour meters fitted with ratchets, three to measure the power in each direction. The metering equipment recently installed at Cottonwood, Cal., is typical of this method of metering, connections being shown in the accompanying diagram. At this point the California Oregon Power Company delivers power to the Pacific Gas & Electric Company over a 110-kv. line tying in with the latter company's 220-kv. lines from the Pit River plants.

When one three-phase wattmeter or two three-phase ratchet wattmeters are used for interchange metering it is possible for the accuracy of the entire arrangement to be destroyed by trouble in the current transformers, potential transformers or the meter itself. If, for instance, a potential transformer fuse was to blow and remain undetected for several days, there would be no basis upon which to estimate the power interchanged. With three single-phase meters trouble in one meter, current or potential transformer would affect that one meter only and the two other meters would be left to measure the energy. As the registrations of the three meters are within 1 per cent of one another, it is possible to estimate the energy transferred quite accurately.

In the Cottonwood installation two graphic demand meters have been provided, one for power in either direction. Dividing the total kilowatt-hours as shown by the sum of the three single-phase wattmeter readings by the demand, the monthly load factor is obtained. Besides the watt-hour and graphic meters there has been provided a zero-center indicating wattmeter, three ammeters, a voltmeter and a synchroscope. The systems are tied together through an oil circuit breaker with current-overload and current-reverse relay protection. All instruments connected to outdoor equipment are installed on a panel in the substation building.

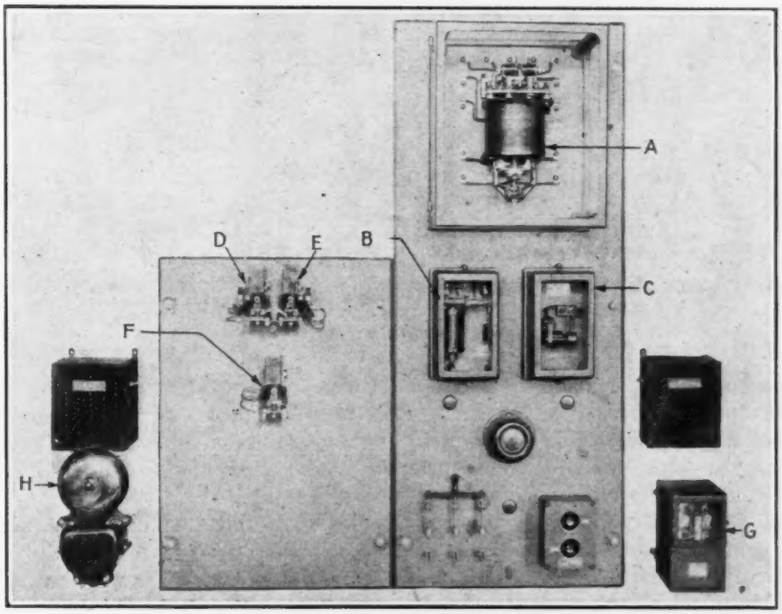
A similar metering arrangement on a 60-kv. tie line with the Pacific Gas & Electric Company has been in satisfactory service for seven years and has fully justified the added expense of the extra equipment required for the single-phase meters.

Automatic Regulator Prevents Load from Exceeding Billing Demand

BY F. A. BYLES
Flow Meter and Regulator Engineering Department,
General Electric Company

A LARGE proportion of the power in the plant of Rockwood & Company, cocoa and chocolate manufacturers of Brooklyn, N. Y., is alternating current, but there are also many direct-current applications. The direct current is supplied from a generator belted to a steam engine, which also drives a mechanical load, and from a motor-generator fed from the lines of the Brooklyn Edison Company. In order to distribute the direct-current load between the two sources so that the Edison supply should be continuously loaded to, but not exceed, the agreed maximum demand an automatic regulator was devised and installed.

The regulator is controlled by a contact-making polyphase wattmeter *A* in the illustration. Relay *B* is connected across a shunt in the line from the 300-kw. direct-current generator and is calibrated to shift the load when the load from this generator is up to its normal capacity. Relay *C* is a notching relay and operates the motor-driven rheostat in the field circuit of the 300-kw. generator at short intervals, when it is necessary to transfer load. This notching action prevents the load from overshifting and upsetting the smoothness of regulation desired. Contactors *E*, *D* and *F* are connected in the rheostat motor-operating cir-



LOAD REGULATOR WITH RELAY EQUIPMENT

cuit and are actuated directly from the contacts of the transfer relays.

Reverse current and load limit relay *G* is mounted on the 200-kw. belted generator control panel, which is located at some distance from the 300-kw. motor-generator switchboard. This relay provides reverse current protection for the belted generator and also carries a set of load limit contacts which are adjusted to hold the desired minimum load on the belted machine.

Another relay similar to *B* is mounted on the 200-kw. belted generator panel and rings gong *H* when the belted generator has received its full quota of load. The necessary push buttons and switches are provided in order that hand control of the system may be obtained at any time for the purpose of making tests or adjustments when necessary.

The operation of the equipment is as follows: When the two direct-current machines are first started and the load begins to come on, the current divides between the two generators in proportion to their respective capacities. In order to obtain stability of operation the regulator will function to maintain a load of approximately 25 kw. on the 200-kw. machine. As soon as the load reaches this point the regulator operates to shift the load to the 300-kw. generator by operating the motor-driven rheostat which is in the field circuit of this machine. As the load continues to build up, the additional load will be put on the 300-kw. generator. When the load is built up to the capacity of the 300-kw. machine, the regulator will operate to divert any additional load to the 200-kw. engine-driven generator, and when both machines have reached their capacities, a relay rings the gong, which calls the attention of the station operator to the fact that part of the direct-current motor load will have to be taken off.

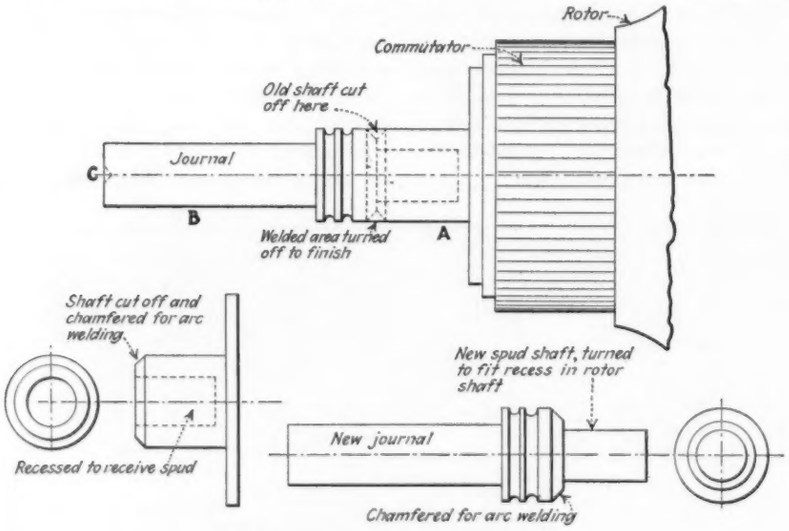
When the maximum demand setting of the main power regulator *A* is reached, the relays will operate the motor-driven rheostat in the field of the 300-kw. direct-current generator so as to shift part of the load back to the 200-kw. generator.

At all times the engine is operating with its regular mechanical load and the 200-kw. belted generator, which is either running with minimum load or carrying such part of its full rated capacity as is required to bring about the necessary load balance.

Method for Repairing Worn Motor Shafts

BY A. F. GRAVES
Pittsfield, Mass.

THE question of repairs to motor shafts and bearings is very important. To keep motors running smoothly and efficiently, both bearings and journals must be in nearly perfect condition—up to standard size and free from roughness and scores. An oversized bearing results in an uneven air gap and should be immediately replaced. A rough or undersized shaft will spoil the best bearing.



REPAIRING WORN MOTOR SHAFT

Three methods of repairing these worn shafts may be used:

1. Replace the shaft entirely. This method is expensive and takes the most time.

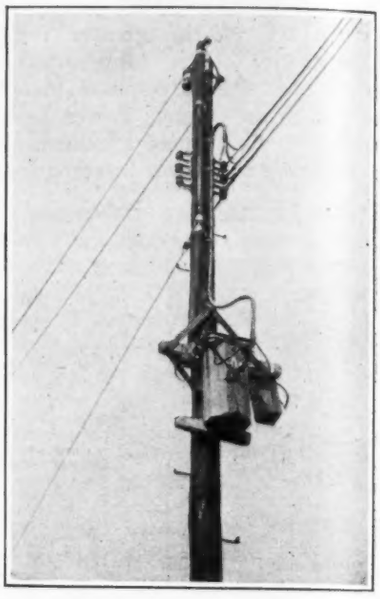
2. Build up the journal by means of arc welding. This method is not very satisfactory, because welding strains the original metal. This shaft will neither finish smooth nor run true.

3. Cut off the worn piece of shaft and replace with a new piece as shown in the sketch. The shaft remaining is recessed and the new end forced into this recess. After chamfering both pieces at the shoulders they are then welded together.

The whole rotor is now mounted in a lathe with the new welded end placed in the chuck and the opposite end on its own center. Indicate the shaft at the point *A* to run true and spot-face at *B*. Next reverse ends of the shaft, mounting the old end in the chuck and placing the steady rest at point *B*, making a new center at *C*. The shaft may now be set up on centers and finished to size.

This method gives a true running shaft with natural machine steel at the journal, which is preferable to the built-up arc-welded journal.

Fiber Duct Used for Primary Leads



THE Union Electric Light & Power Company of St. Louis uses 2-in. fiber duct to bring 2,300-volt primaries from the pole-top to the transformer. Secondaries are carried back up the pole in 500-volt lead cable. The accompanying illustration shows a typical installation of this kind and also shows the primary pole-top and secondary rack construction. Excellent results have been obtained and the company has adopted this layout as a standard for construction in residential districts.

Commercial Activities and Public Relations

Chicago Utility's Experience with Domestic Refrigerator

MORE than 2,000 domestic electric refrigerators are used in Chicago homes, despite the fact that Chicago proper is chiefly composed of rented homes the owners of which, rather than the occupants, must be shown an advantage in supplanting ice boxes by electric refrigerators. Based on 34 installations of the machines, the annual consumption per unit is about 600 kw.-hr., which, at 3 cents per kw.-hr., brings about $18 per year, or $1.50 per month. On these installations, electric refrigeration increased the customer's summer consumption about 66 per cent and the winter consumption 41 per cent, according to G. L. Jorgensen, statistical department, Commonwealth Edison Company.

Adding electric refrigerators to existing customer's loads requires no additional meter or changes in the service drops, declares T. G. Le Clair of the engineering department of the same company. With a number of refrigerators installed their aggregate load is practically constant throughout the 24 hours, and is about two and one-half times as great in summer as in winter. Because of this fact and their relatively large consumption (compared with domestic lighting), domestic refrigerators constitute a very desirable addition to residence load.

As is the case with automobiles, domestic refrigerators must have reliability backed by first-class servicing, points out F. W. Boldenweck of the contract department. The expense of servicing can be minimized by design and construction that largely eliminate troubles and breakdowns. Such development of the unit being sold by the Commonwealth Edison Company has been brought about to a great extent by suggestions of the service and repair department. This department is equipped to give 24-hour service to all users of this refrigerator.

Four important factors in the sales campaign, emphasized by W. T. Reace of the contract department, are: The prospect list, the advertising campaign, electric shop and exposition displays and the sales force organization. Since 40 per cent of the families in this country do not use any kind of artificial refrigeration and only 9 per cent use it the year around, it is essential to look to the year-around users for immediate prospects. In advertising, the public must be made to realize that retardation of bacterial growth and food decomposition demands a temperature below 50 deg. F., which is readily attainable with electric refrigeration. The electric refrigerator, displayed in operating condition, serves as an ideal demonstration for electric shops and public exhibits. Past experience, says Mr. Reace, shows that refrigerator salesmen should be specialty men devoting their entire time to the article.

Since every domestic refrigerator installed takes a customer away from an ice company, which perhaps uses purchased power, and shifts load from an industrial customer to a domestic customer, it has been looked upon by some utilities with trepidation. However, F. H. White, Jr., of the contract department, points out that even with 150,000 domestic refrigerators in use at the end of 1925, ice companies lost only 1½ per cent of their total business to competition. Furthermore, in a recent domestic refrigerator campaign in South Bend, Ind., due to the educational character of the campaign, the local ice companies obtained ten new ice customers for every electric refrigerator sold.

Direct-Mail Contact and Advertising of Service

THE Consolidated Gas, Electric Light & Power Company of Baltimore is making use of a scheme for keeping alive the interest of existing and potential customers which is somewhat different from the methods used by most central stations. This scheme makes use of two publications, one of which is entitled "Power Pictorial," which is published from time to time and is sent to consumers on the lines and to prospects. The second of these is a booklet entitled "Power Plant Analysis" and is addressed particularly to prospects for the sale of industrial power. Both of these booklets are about 5x8 in., are attractively bound in heavy paper covers and are very good examples of the typographical art.

BOOKLETS DISTRIBUTED TO PROSPECTS AND CONSUMERS OF THE CONSOLIDATED GAS, ELECTRIC LIGHT & POWER COMPANY OF BALTIMORE

The present issue of "Power Pictorial," No. 6, opens with a section on industrial power. Descriptions are given of various industrial plants which have lately come upon the lines of the company, together with many photographs of the plants of the new

customers. The next section is concerned with electric heat and its industrial, commercial and residential applications. Following this is a section on electrical refrigeration, and then comes a division of factory lighting, followed by electric trucks and industrial gas. Each of these divisions is given a local news value by more or less detailed mention of new installations.

The second publication, "Power Plant Analysis," is addressed to the industrial plants of Baltimore and points out the economies and advantages of electric service from the central station. Explanations and typical calculations for all kinds of industrial power tests are included in the book. Boiler tests, steam engine tests, pump tests—in fact, tests of all kinds of industrial machinery to which electric power can be applied —are included. As an appendix to the volume there is included a complete test and analysis covering an actual plant in Baltimore.

The value of this booklet should be very great, since it puts into the hands of the potential buyer of electric energy detailed information which will either impel him to make a sufficient study of his power requirements or so stir his interest as to cause him to invoke the assistance of the power company's engineering department.

Interest in Texas Women's Essay Contests Increases

WHEN the essay contest for women employees conducted by the women's committee of the Southwest Geographic Division of the N.E.L.A. closed on Jan. 15, 103 essays had been received from Texas alone. This is a large increase over those received last year and indicates the interest shown by women employees in the Southwestern states in their work with the utilities and the importance of public relations.

The Eastern Texas Electric Company, with headquarters at Beaumont, Tex., is an example of the way in which this activity is broadening. Last year five women employees submitted essays; this year thirteen entered the contest. Mrs. H. L. Ganchan, a stenographer in the commercial department, won first place in the state, and five other essays submitted by woman employees from the power station and other company departments won places among the first twenty.

Electric Range Service in Rural Districts

Survey Made on Rural Lines in Alabama Shows that Average Load for Cooking Is 125 Kw.-Hr. per Month— Method of Study and Progress to Date

BY M. L. NICHOLS* AND E. C. EASTER†
Alabama Polytechnic Institute, Auburn, Ala.

IN AN effort to increase the profitable energy consumption by rural customers in Alabama, no single use of electricity has been more important than electric cooking. On Sept. 1 of last year 1,370 rural customers in Alabama, of whom about one hundred used electric ranges, were receiving electric service from the Alabama Power Company. A great many of these ranges are used on farms where there is plenty of stove wood and all of them in proximity to a supply of wood. For this reason a careful study has been made of the operation of the electric range on the rural lines in Alabama to determine its practical cost and value to rural customers.

In making this investigation the following work was done: (a) A record was made of the energy used per month by each range customer on the rural lines of the state, from January through May of 1925. (b) Separate watt-hour meters were placed on three electric ranges to determine the amount of energy used on the range alone. (c) At the home economics practice house at Auburn a record was kept of the energy consumed by the range for each meal, the number of persons served and the energy used per person per meal. (d) Questionnaires were mailed to all range customers to obtain their opinions. (e) Many of the customers were visited and their opinions obtained through personal interviews.

The record of energy consumption from January through May is given in Table I. Due to the fact that range customers of the Alabama Power Company are served through one meter which registers the current used for cooking, water heating, lighting, all small household appliances and motors not larger than 1 hp., the energy consumption given is not for the range alone but for all of the equipment used. No part-month customers or customers without meter readings are included. For the 326 range-months the average consumption per range customer was 187 kw.-hr. per month. Of the 75 customers tabulated for May, six used less than 50 kw.-hr. per month, sixteen from 50 to 100 kw.-hr., fifteen from 100 to 150 kw.-hr., twelve from 150 to 200 kw.-hr., seven from 200 to 250 kw.-hr., nine from 250 to 300 kw.-hr., eight from 300 to 350 kw.-hr. and two more than 350 kw.-hr. This variation is due very

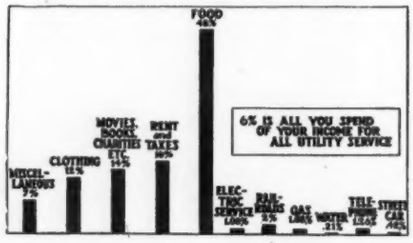
*Head of the Agricultural Engineering Department.
†Associate Agricultural Engineer.

TABLE I—ELECTRICAL ENERGY CONSUMPTION OF RANGE CUSTOMERS

Month	Range Customers	Total Energy Consumption, Kw.-Hr.	Energy per Range Customer, Kw.-Hr.
January.....	57	9,560	166
February.....	61	11,037	181
March.....	63	10,407	165
April.....	70	13,922	200
May.....	75	15,803	211
Total.....	326	60,801	187

Living Expenses— Engineering and Otherwise

BY C. M. RIPLEY
General Electric Company,
Schenectady, N. Y.



THIS chart, prepared by the Society for Electrical Development, gives one a bird's-eye view of our household and living expenses, averaged for 110,000,000 people. In order to allow them to be quickly grasped by the eye, these expense items are classified in two groups—the engineering group on the right, and the non-engineering group on the left.

Study this chart—it is illuminating. It shows that 94 per cent of the money spent by the American people goes for the things on the left side—the non-engineering expenses. On the right side the engineering expenses are shown, and they get 6 cents out of every dollar we spend.

If by proper co-operation and co-ordination between the farmer and the city dweller the cost of food could be lessened 13 per cent, that would be equal to what we spend for the engineering services, shown on the right-hand side of the picture. A 13 per cent saving in food would be tremendous, but a 13 per cent saving in any or even all of the engineering items would be, relatively, a mere bagatelle.

TABLE II—ENERGY USED BY THE RANGE ALONE ON RURAL LINES

Range	Persons Cooked For	Months	Average Energy Used per Month
1	3	16	127
2	3	4¾	129
3	4	3	112
Average	3¾	7.9	125

TABLE III—ENERGY USED BY ELECTRIC RANGE PER PERSON PER MEAL

	Meals Prepared	Person Meals	Total Energy, Kw.-Hr.	Energy per Meal, Kw.-Hr.	Energy per Person per Meal, Kw.-Hr.
Breakfast....	66	469	181	2.74	0.38
Luncheon...	65	462	236	3.65	0.51
Dinner.....	64	448	321	5.00	0.72
Total.....	195	1,379	738	3.78	0.54

largely to the uses other than for cooking made of electricity on the various farms.

The energy consumption of the three ranges metered is given in Table II. As can be seen, these three ranges were operated for a total of 23⅞ months with an average consumption of 125 kw.-hr. per range. The first range was used to prepare an average of two meals per day, whereas the two others were used for three meals per day. It is thought that the average housewife should be able to operate a range with this energy consumption.

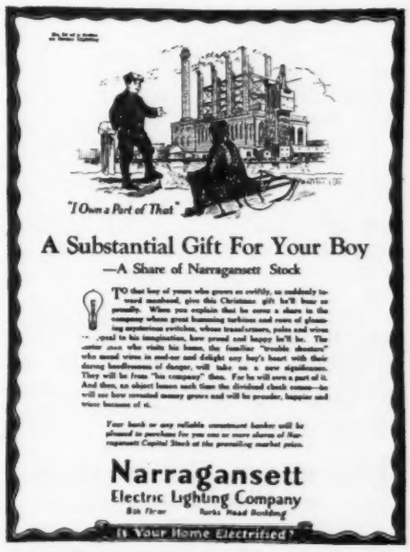
To determine the amount of energy required to prepare meals per person, a record was kept of the operation of the electric range at the Alabama Polytechnic Institute practice house for a period of 70 days. This range was operated by girl students taking practice training, under very close supervision of the home economics department. The results are shown in Table III. A total of 195 meals to serve 1,379 persons were prepared with 738 kw.-hr., an average of 0.54 kw.-hr. per person per meal. The total figures are naturally somewhat higher than would be used by an average family due to the number of persons served. In this case an average of seven persons were served with no meals missed, but the average family does not consist of that many persons. Also, in practical operation, some meals are missed every month. This table does give a fairly accurate indication of the energy a range would use for a given number of persons and a given number of meals. This would, of course, vary with different operations, food prepared and other factors.

In answer to the questionnaire sent out the following advantages were listed (sixteen questionnaires were returned): Saves time, cooler kitchen in summer, cleaner, safer, food cooked better, cheaper, more even heat and automatic heat control.

Two customers complained of service interruptions, two of insufficient heat in kitchen for winter, and one person did not know how to operate the range. The average number of lights used by those answering was seventeen, and nine irons, five water pumps, three water heaters, one household refrigerator, one dishwasher, one sewing machine, one electric fan, two small shop motors and three vacuum cleaners were used. The average price of the ranges was $179. Ten of the sixteen used the range for three meals per day, two for two meals, three for one meal and one did not answer this question.

Utility Stock Ownership Teaches Boys Thrift

PARTICIPATION by the rising generation in stock ownership is effectively featured in recent newspaper advertising of the Narragansett Electric Lighting Company, Providence, R. I., as shown by the insertion reproduced herewith. The advertisement sets forth the value of a real interest in the company to a growing boy and emphasizes the thrift lesson and pride of ownership resulting from possessing even a single share of stock.


"I Own a Part of That"
A Substantial Gift For Your Boy
—A Share of Narragansett Stock
Narragansett
Electric Lighting Company
Is Your Home Electrified?

BENDING THE YOUTHFUL POSSESSIVE INSTINCT IN THE RIGHT DIRECTION

Electric Water Heating as Rural Load

ELECTRIC heating of water for farm use is attracting considerable attention, so the following preliminary report on some observations that have been made on actual installations are submitted by the Wisconsin Utilities Association. It is to be recognized that these detached items are very probably not sufficient for the formation of conclusions in regard to this class of service.

On the Ripon experimental line two electric water heaters have been installed. One furnishes a residence with hot water, the other is used in a dairy. Although the heater for domestic use appears a luxury, its convenience in furnishing instant hot water for cooking, toilet and bath cannot be defined in money terms. The heater in the dairy provides a safe, convenient source of hot water for washing dairy utensils and saves carrying either the hot water or the utensils. The following observations have been made:

Size.....	10 gal.....	5 gal.
Heating element	5 kw.....	2 kw.
Regulation.....	Thermostatic	Manual
Water heated per mo.	885 gal.....	120 gal. (est.)
Average monthly energy.....	367 kw.-hr...	57 kw.-hr.

The 10-gal. unit heated all water for domestic use, including laundry, dish washing, toilet and bath. The smaller unit was used for washing the cream separator, milking machine and utensils in the dairy. They are thoroughly washed each morning, and in the evening they are simply rinsed in the warm water remaining in the tank from the morning run.

At a three-cent energy rate this application shows an average current cost of 1.25 to 1.4 cents per gallon of hot water under typical farm conditions.

The following data indicate the effect of tank insulation by showing how slowly the temperature of the water falls in the 5-gal. heater with a large opening in the top:

Oct. 13.
8:19 a.m.....122 deg. F.
5:09 p.m.....102 deg. F.
Eight hours, 50 minutes, 20 deg. drop in temperature.

This particular tank is not connected with a water piping system, but the opening at the top, intended for bushing down to the pipe connection, is used for pouring in the water to be heated and drawn off for use in the dairy.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Biannual B. B. C. Report.—K. SACHS and P. FABER.—This 44-page article gives an account of important developments and unusual shipments made by Brown-Boveri during the years 1924 and 1925. The paper, which is illustrated with 87 photographs and drawings, is a valuable epitome of up-to-date Swiss construction, covering the entire range of electrical machinery and steam-turbine design as manufactured by this firm. It is impossible to abstract a paper of this nature, because every item mentioned is remarkable in its line and was incorporated in the report for that very reason. American designers will no doubt find many interesting suggestions in the article. As outstanding features may be mentioned at random a 30,000-kva., 8,000-volt, three-phase generator, a synchronous-motor double-generator set of 3,000 hp. for 6,900 amp. at 195 volts direct current, a three-phase transformer for 30,000 kva. at 155 kv., a single-phase transformer of 9,000 kva. at 16⅔ cycles for 132 kv., cooled with a bank of radiators, mercury-arc rectifiers with up to 1,600 amp. load current per cylinder, and a newly developed automatic alternating-current ignition system for rectifiers which obviates use of the small ignition motor-generator previously required. A new line of arc furnaces was developed wherein the electrodes are moved up and down by means of a hydraulic cylinder and piston arrangement. A number of large noteworthy electric locomotives were built during these two years, both for alternating and direct-current operation.—*Brown-Boveri Mitteilungen*, January, 1926.

Distillation Products of Coal.—The leading processes for the low-temperature carbonization of coal are briefly reviewed, and their utility as sources of either domestic smokeless fuel or of coke suitable for powdered-coal furnaces is discussed. Byproducts of distillation are taken up, and consideration is given to the carbonization of low-grade lignites. It appears that low-temperature carbonization processes will probably be first developed in connection with large pulverized-fuel-fired central stations. Several are already under development and a statement covering one is included. Very few data on tests or operating performance are available at the present time, but several important books have lately been published and one of these is reviewed. This study indicates that much development work must be carried out before these processes reach a commercial stage, and further that hydrogenation and synthetic methods must also be studied and developed as they may have considerable influence on the economics of low-temperature distillation. American power interests would, it is suggested, do well to encourage research and development along these lines as scientists in other nations are very busy and may develop and patent fundamental processes which could then be used here only on payment of royalties.—*Serial Report of Prime Movers Committee of Technical National Section of N. E. L. A.*, February, 1926.

Generation, Control, Switching and Protection

Ratings of Electrical Machines as Affected by Altitude.—CARL J. FECHHEIMER.—A brief abstract of this paper may be found in the ELECTRICAL WORLD'S report of the midwinter A.I.E.E. convention, Feb. 20, page 397. Ignoring differences in ambient temperature, the effect of altitude may be considered from two standpoints—(a) the change in temperature rise, the rating remaining the same, or (b) the change in rating, the temperature at a given altitude equaling that at sea level. In the paper the applications of both are considered and equations are solved both ways. The difference in ambient temperature at sea level and at altitude is also taken into consideration in other equations. The paper undertakes to meet the objections to the present A.I.E.E. rule, which applies only to temperature change, is known to be faulty and starts at 1,000 ft. In the analysis two factors are used. One is the fraction k of the embedded loss that is proportional to the square of the load. This is shown by tests of a number of machines to have an average value of 0.4 to 0.5. The other, m, is the barometric pressure ratio exponent and depends upon the rate at which heat is transferred from a heated surface to the moving fluid and upon the temperature increase of the cooling fluid from entrance to the point under consideration. For this factor a value of 0.9 seems to be reasonable. Taking a single example, with $m = 0.9$ and $k = 0.4$ the effect of 1,000 ft. of altitude is to cut the rating to about 86 per cent of the sea-level value; of 2,000 ft., to 73 per cent; of 3,000 ft., to 56 per cent, and of 4,000 ft., to 35 per cent. The effects of changes in the variables and of a change in permissible temperature rise are shown by families of curves.—*Journal of A.I.E.E.*, February, 1926.

Transmission, Substations and Distribution

Calculation of Current-Carrying Capacity of Type H Cable.—DONALD M. SIMONS.—The peculiarity of type H cable is that all the insulation is around the three individual conductors, each insulated conductor being in turn surrounded by a thin metallic tape. The three are cabled together and surrounded by a lead sheath, which is in contact with the metallic tape. Tracing the thermal flow in one of the elements, there is first the heat developed in the conductor, which flows out radially through the dielectric to the tape; next the heat due to dielectric loss, which, being generated within the dielectric itself, has to traverse only a portion of the latter, and finally the circumferential flow in the tape to the region of contact between tape and sheath. If the tape is thin, there is an appreciable temperature gradient in it, which must also be taken into account. This problem the author investigates mathematically. Comparing thermal resistances of type H and belted cables of equal size of conductor and outside diameter, the former is stated to be roughly half that of the latter; but in figuring current-carrying capacities the total thermal resistance is the determining factor and this is affected by the number of conductors per duct bank. With many cables per bank the increase may be from 5 to 25 per cent, while in submarine cable it may exceed 50 per cent.—*Electric Journal*, February, 1926.

High-Voltage Insulators.—M. BUCOV.—The paper describes developments made during the last two years on outdoor insulators for medium and high voltages. The largest part of the article deals with new small-type chain insulators, which are more and more used instead of pin-type porcelains. High electrical and mechanical strength are important features of these new insulators. Sphere-head and so-called "motor" insulators have been greatly improved in late years. The six-page article is illustrated with 20 drawings of porcelain insulators.—*Elektrotechnik und Maschinenbau*, Jan. 3, 1926.

Units, Measurements and Instruments

New Wave-Shape Factor and Meter.—L. A. DOGGETT, J. W. HEIM and M. W. WHITE.—An abstract of this paper may be found in the report of the midwinter convention of the A.I.E.E. in the ELECTRICAL WORLD for Feb. 20, 1926, on page 398.—*Journal of A.I.E.E.*, February, 1926.

Testing Static Transformers.—J. L. THOMPSON and H. WALMSLEY.—In this abstract of a paper read before the Institution of Electrical Engineers methods of making the various usual tests on transformers are assembled. In general they are methods well known to electrical engineers. Several ways of separating the iron losses are given, all based on the assumption of the exponent 1.6 for the hysteresis loss, and all of them graphic. No mention is made, however, of the use of logarithmic paper. Another abstract of the same paper takes up in greater detail the potential tests that may be applied and the measurement of crest voltages. The statement is made that where abnormal tests are to be made, such as three or four times normal voltage, higher frequency is necessary to secure the test voltages; but the suggestion is added that this should not exceed 175 cycles, to guard against troubles caused by the intense static fields and discharges under oil.—*Electrician* (*England*), Jan. 29, and *Engineer* (*England*), Feb. 5, 1926.

Phase Rotation Indicator.—H. L. HILLENBRAND.—The phase-rotation indicator here described consists of two lamps and an inductance connected in Y and constituting an unbalanced circuit; that is, the neutral point is not in the center of the vector triangle of

voltages. When this circuit is solved it is found that a higher voltage is impressed on the lamp that comes first in the direction of phase rotation than on the other. If, for example, the resistance of each lamp is 100 ohms and the reactance is 10, the lamp voltages are 106.6 and 89.6 per cent of line voltage respectively. The brightness thus provides an indication of the rotation.—*Electric Journal*, February, 1926.

Motors and Control

Synchronous Converters and Synchronous Motor-Generator Sets Compared for Industrial Service.—W. B. SNYDER. — The comparison, which is largely in general terms, touches on first cost, efficiency, power factor, terms of the contract for energy supply and operating conditions on the direct-current side. — *General Electric Review*, February, 1926.

Induction Motor Starting Without Starter.—C. SCHENFER.—Rotor windings arranged in so-called "counter-connection," as recommended by Gorges for induction motors, have the disadvantage of a relatively small starting torque, due to the very considerable phase displacement between the rotor current and the line current. An endeavor to overcome this difficulty has led to the employment of ohmic resistances, introduced during the starting period in the rotor, by the use of starters. The author has investigated the possibility of utilizing part of the rotor winding itself as ohmic resistance, because it is feasible to connect certain parts of the armature winding in groups which consist of unidirectional but counter-connected parts of phases serving as ohmic resistances for other rotor phases. A detailed theoretical analysis of this innovation is given, together with results from actual tests made on motors which have been changed for this purpose.—*Elektrotechnik und Maschinenbau*, Jan. 31, 1926.

Heat Applications and Material Handling

Comparative Cooking Cost.—J. RUTISHAUSER.—In a Swiss sanitarium with 145 patients arrangements were made to provide the central kitchen with coal stoves, gas stoves and electric stoves and to prepare all food on alternate weeks by one or the other set of stoves, always following the same rotation of menus. Very accurate records were kept on coal, gas and energy consumed, time, cost of attendance, depreciation, interest on investment, etc., so as to obtain fully reliable and comparable data. These are tabulated in three pages of the paper. It seems that in Davos, Switzerland, gas operation costs about the same as coal operation, while cooking with electricity proved decidedly cheaper than either of the two other methods, aside from the many other advantages inherent in electrical operation. The writer emphasizes that these tests were not small-scale laboratory tests, but that they represented actual conditions such as will be found in any hotel or other enterprise of corresponding size. Both electric and gas costs, he observes, can be greatly increased by wasteful use, such as tardy disconnection or excessive heat for simmering.—*Bulletin de l'Association Suisse des Electriciens*, December, 1925.

Telegraphy, Telephony, Radio and Signals

Transmission on the Higher Radio Frequencies.—A. HOYT TAYLOR.—A summary has been made, which is here presented graphically, of the range data for various frequencies so far as it can be estimated from experiments by the Naval Research Laboratory and from other sources. The range chart is based on 5 kw. at the antenna, average antenna installation and communication between points on the same meridian. The frequencies studied run up to 20,000 kc. The ranges are plotted for daylight, for winter night and for summer night. Depending on the frequency, there are certain ranges which the radiation skips entirely; for instance, the 15,000-kc band misses the region from 75 to 700 miles. Only a few items can be abstracted. From 100 to 2,000 kc. the daylight range decreases from 1,200 to 125 miles and the winter night range continues almost unchanged around 2,000 (2,500 uncertain), being at the higher frequency enormously greater than the daylight range. Between 2,000 kc. and 3,000 kc. there is a rather abrupt change, the daylight range becoming greater than 200 miles, the summer night range rising to more than 2,000 and the winter night range being certain up to 6,000 miles. This change continues, so that at 6,000 kc. the daylight range extends to 1,000 miles and the summer night range to 4,000, possibly to 7,000, while the winter night range goes to at least 7,000 and perhaps to 10,000. It is around this frequency that the uncertain region close to the transmitter makes its appearance. On the whole, the data on the high frequencies show clearly their enormous superiority as to cost and power economy.—*Proceedings I. R. E.*, December, 1925.

Electrophysics, Electrochemistry and Batteries

Electrical Discharges Between High-Resistance Electrodes.—J. SLEPIAN.—In a preceding paper, abstracted in the Digest, it was shown that the transition from a glow discharge to an arc at atmospheric pressure is not due to the heating of the cathode by the glow, but that the glow changes over into a low-voltage concentrated discharge long before the cathode attains a high temperature, and the theory was advanced that the transition is caused by heating and thermal ionization of the gas in the cathode dark space. The thermal ionization causes an increase in the current density, which in turn causes a further increase in the cathode dark-space temperature, thus producing an instability whereby the whole current converges into a single point with extremely high current density. By using high-resistivity electrodes it should be possible to prevent this concentration. The experiment was tried, the material being cut into disks and connected in a circuit with a 220-volt alternating-current supply, the gap between the disks being broken down by the discharge of a condenser. When the resistance of the material exceeded 20 ohms per cubic centimeter no current would flow in the 220-volt mains across the gap between the disks after the breakdown; but if low-resistivity material was used an alternating-current arc would be maintained. The appearance of the arc indicated that the resistivity was preventing the concentration of the current, for the discharge would fill the whole gap. The phenomenon has been applied to the construction of lightning arresters.—*Journal of Franklin Institute*, February, 1926.

Laws Governing Pulling of Electrons Out of Metals by Intense Electrical Fields.—R. A. MILLIKAN. and CARL F. EYRING.—Three filaments were tested, each 0.00123 cm. in diameter and suspended under tension in the axis of a copper cylinder of 1.6 cm. diameter. The electron currents pulled from the tungsten by the high fields (field currents) rise steadily from 10^{-12} to 10^{-3} amp. as the field is increased from about 400 volts to 1,100 volts per centimeter. The currents appear to come from a few active surface spots. The field current for a given voltage depends on the value of the maximum field current previously drawn from it (conditioning current), being reversibly reproducible below the conditioning current. The higher the conditioning current the lower the field current. A previous heating to high temperatures (2,400 deg. C.) decreases the field current and also decreases the slope of the current-voltage curve. Both effects show fatigue. The field currents are completely independent of temperature up to 700 deg., but a temperature of 800 deg. increases the currents due to a given field, when this is sufficiently large, by a factor which is roughly independent of the current (10^{-5} amp. to 10^{-4} amp.). A theory to account for these results is suggested. — *Physical Review*, January, 1926.

Miscellaneous

Electric Fodder Preservation. — F. RUTGERS.—Tests made by a large Swiss manufacturing concern for several years past on modern farms with electric fodder conservation have proved that even for rain-wet grass this method gives very good results. If the process is carried on carefully, any formation of butter-acid or generation of bacteria may be avoided with certainty. On one farm 150 tons of grass has been conserved for three years. The fodder is firmly pressed into a silo, and 250-volt to 500-volt alternating current is passed through the contents for 24 to 48 hours by an electrode with a metallic top and bottom. The feeding transformer should be arranged for series-parallel connection, to give two voltages. The energy requirement will vary between 3 kw.-hr. and 6 kw.-hr. for every 100 kg. of grass. Feeding of electrically conserved fodder has been found unsuitable only on farms where the milk from cows is used for the manufacture of Swiss cheese. Attemps are being made now to reduce the cost, still high, of such installations. —*Bulletin de l'Association Suisse des Electriciens*, December, 1925.

Scientific & Industrial Research

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Bridge, Double-Percentage

This instrument is essentially a double bridge supplied with two slide wires which are used in equalizing the ratio coils. The resistance of the ratio coils bears such a relation to that of the slide wires that the ratio coils may be used as the auxiliary coils in a percentage bridge. In addition to simplifying the process of equalizing the ratio coils, this device offers a simple and exact method of balancing the bridge, without shunting either of the standards or resorting to the rather unsatisfactory method of interpreting galvanometer deflections. For details see *Optical Society of America Journal*, 1926, Vol. 12, page 131.—*A. C. Longden, Knox College, Galesburg, Ill.*

Cable Sheath, Wear of, at Duct Edges

Tests were made for the purpose of determining the relative efficiency of a number of forms of duct entrances as follows: (1) Fiber duct, belled end, with roller support, minimum diameter of roller 1¼ in.; roller set back from duct edge to allow fire protection to enter duct. (2) Fiber duct with roller support, minimum diameter of roller 1 in.; roller removed and hardwood support used instead, held in position by slots in the wood which fit over bearings. (3) Fiber duct usual construction. (4) Cement finished, (1) of cement, (2) of sand, bottom rounded off to get curvature of cable. (5) Tile duct. (6) Same as (3) with lead collar placed under the cable.—*Underground Systems Committee of the N. E. L. A.*

Insulators, Cement Expansion in

The cyclic variations of the volume of cement under repeated wettings and dryings have been investigated. The outstanding features of the results are the relatively large variations in volume found to occur and the discovery that the volume is not a single valued function of the moisture content of the cement, but depends upon past history as to whether the cement is still absorbing moisture or is drying out.—*Harris J. Ryan, Stanford University, California.*

Manholes, Ventilation of

A recording thermometer was placed in the manhole, under test, and allowed to remain there for twenty-four hours with the ventilating features functioning in their natural manner. Following this, all ventilation was shut off completely, this creating a condition as if the manhole had not been ventilated. The curves show the average difference between the two existing conditions of tests to be 16.44 deg. C., the average outside temperature being 25.6 deg. C.—*Underground Systems Committee of the N. E. L. A.*

Resistance of Fine Wires at High Frequencies

A new method has been developed for making simultaneous measurements of high-frequency resistance and d.c.-resistance of small wires at any temperature desired, up to that at which the test wire will not support its own weight. The method is applicable up to any frequency limit for which the inductive reactance of the test wire is negligible as compared to the resistance; it is even applicable to higher frequencies provided proper account is taken of the reactance of the wire. The accuracy at these higher frequencies, however, is not so good. The high-frequency resistance (at 3.12×10^6 cycles) of small platinum wires was found to be equal to the d.c. resistance at all temperatures, whether in air, in vacuum, or in an atmosphere of H_2.—*J. D. Stranathan, Blake Laboratory, University of Kansas, Lawrence, Kan.*

[An account of the method used will be found in *Physical Review*, 1925, Vol. 26, page 500.—EDITOR.]

Spectroscope, Ultra-Violet

The device has a quartz train. It is in permanent adjustment, and the ultra-violet spectra of any light sources (as, for instance, those of an arc lamp) are thrown on the fluorescent screen and are easily viewed with the naked eye. There is an engraved scale of wave lengths, on which the rays can be read off, and the instrument transmits and makes visible the whole of the ultra-violet spectrum, as far as the shortest wave lengths transmitted by air in the region of 1,850 A.—*Adam Hilger, Limited, 24 Rochester Place, London, N. W. 1, England.*

Thermometer, Resistance-Type, Small

This thermometer, which was developed for field observations in the Department of Agriculture, fits into a sheath only about 6.4 cm. long and 0.24 cm. in diameter and may be made even smaller. It consists of a Pb filament 1.5 cm. long and 2×10^{-3} mm. in diameter in a glass tube 4×10^{-5} mm. thick, embedded in a type metal which makes contact with one end of the filament. The resistance of the filament is 448 ohms, so that with a portable galvanometer a sensitivity of 0.005 deg. is readily obtained. The temperature lag is about 10 seconds. For details see *Physical Review*, 1925, Vol. 26, page 841.—*G. F. Taylor, Bureau of Plant Industry, Washington.*

Voltmeter Measurements with Vacuum-Tube Amplifier

When the difference of potential across a condenser is read from a low-impedance voltmeter placed in parallel with the condenser, the reading is not the difference of potential across the condenser with the voltmeter removed. This is due to the fact that the impedance of the parallel circuit of condenser and voltmeter is not that of the condenser alone. This inaccuracy may be overcome by using the vacuum-tube voltmeter arrangement discussed by Van der Bijl in his "Thermionic Vacuum Tubes." For details see *Optical Society of America Journal*, 1926, Vol. 12, page 71.—*A. L. Fitch, University of Maine, Orono.*

In Progress or Purposed

Insulators, Dye Test for Porosity of

Investigation is under way of the effect of time of application, amount of pressure and the use of alcoholic or aqueous solutions upon the penetration of dye in determining porosity. A series of specimens fired at different temperatures has been prepared, and a dye press usable up to pressures of 30,000 lb. per square inch has been constructed. This work is progressing favorably.—*R. J. C. Wood, Southern California Edison Company, Los Angeles.*

Suggestions for Research

Breakdown Field Intensity with Spherical Electrodes

In the *Arch für Elek.*, 1924, Vol. 12, page 593, W. O. Schumann deduces a mathematical theory of breakdown on the basis of ionization by collision. He also suggests how to separate the individual factors by varying the pressure, temperature, field intensity and sparking distance. It seems that so far no experimental verification or refutation of this theory has been published.

Cable, Transient Temperature Rise in

Short pieces of single-conductor rubber-covered cable are often used for connections to starters and other intermittent service. It is desired to develop general equations of temperature rise in such a cable, with a variable input, taking into consideration varying heat conductivity and specific heat of rubber as functions of temperature.

Dielectric Strength at High Altitudes

Electrical machinery and apparatus when operating at a high altitude have a lower limit of corona formation and flashover than at the sea level. It is desired to investigate the extent of this difference and to recommend either a more severe dielectric test or suitable changes in the construction to account for this difference.

Generators, Alternating-Current, High-Tension, Dielectric Test for

The present A. I. E. E. standards call for a dielectric test on a new machine of twice the rated voltage plus 1 kv. At the recent meetings of the International Electrotechnical Commission unsuccessful proposals were made by some European delegates to increase the test voltage and to make it a function of the kva. rating of the machine as well. Since such proposals will probably be pressed in the future, it is desired to investigate the various effects of such a higher test, from both the manufacturer's and the user's point of view.

Heat Flow in Turbo-Alternators

In a paper on the subject V. Karapetoff considers the stator winding and the stator core as two metal bodies of infinite conductivity separated by imperfect heat insulation (*A. I. E. E. Journal*, 1926, Vol. 45, page 40). It has been pointed out that considerable differences in temperature exist between various parts of the winding, and the same is true of the core. It is therefore desired to extend his treatment by assuming the temperature of the winding to be a function not only of time but of the distance from the center of the machine as well. In the core the temperature may be assumed to be a function of time and of the radial distance from the center line of the shaft.

Networks, Alternating-Current

The central-station group is waiting for the manufacturers to produce a suitable line of protective devices, and the manufacturers are waiting for the central stations to agree on and indicate just what they wish to accomplish. It is understandable that the manufacturers will not become interested until the central stations agree on a system and methods of protection. Therefore, it is important that something be done on standardizing ideas. When this is done something definite can be furnished to the manufacturers as to requirements, and they no doubt will be able to standardize and produce devices at reasonable cost.

Oscillograph, Electrostatic

In studying high-tension dielectric phenomena it is of advantage to have an electrostatic oscillograph which can stand a high voltage directly and consume no current. Such an oscillograph, based on electrostatic attraction between a plate and a vibrating strip, has been described by J. A. Crowther (*Cambridge Philosophical Society Proceedings*, 1924, Vol. 22, page 68), and its further development and application to practical problems is desired. For a somewhat different construction see E. Pugno-Vanoni, *Elettrotecnica*, 1924, Vol. 11, page 388.

Pollution, Atmospheric, and Potential Gradient

There seems to be a definite relationship between the degree of pollution of the atmosphere by smoke and gases and the potential gradient due to atmospheric electricity. It would be of considerable practical interest to develop a fairly simple experimental method for determining the degree of pollution on this basis. For some observations, see *Royal Society Proceedings*, 1924, Vol. 105, page 311.

Triode Tube, Study of, by Means of a Cathode-Ray Oscillograph

Currents in a triode tube are usually so small that it is difficult to determine their actual wave form without special devices. With the development of very sensitive cathode-ray oscillographs, these seem to offer a promising means for a detailed study of triode tubes. For an attempt in this direction see W. Schmitz, *Zeits. Tech. Phys.*, 1924, Vol. 5, page 94.

Turbo-Alternators, Temperature Rise in

In large high-speed machines, especially in those with concentric armature winding (of the one-coil-per-slot type), the end parts of the stator core become hot under load. This may be due to the losses caused by the leakage fluxes around the heads of the coils. It is desired to investigate whether temperature detectors in such machines should be placed, as heretofore, near the center of the core, or whether the hottest spot lies somewhere near the ends of the core.

News of the Industry

Institute at Cleveland

Regional Meeting Takes up Electrification of Paper-Making Machines and Refrigeration

ELECTRIFICATION of paper-making machines and development of sectional drive were chief topics of discussion at the two-day regional meeting of the Middle Eastern District, American Institute of Electrical Engineers, held at the Hotel Cleveland, Cleveland, on Thursday and Friday of this week. As the ELECTRICAL WORLD went to press registrations indicated an attendance of between 250 and 300. A. G. Pierce, vice-president of the Institute, welcomed the delegates and turned the meeting over to A. M. MacCutcheon, general chairman.

On Thursday two technical sessions were held with three papers on sectional electric drive in paper mills. Stephen A. Staege, Westinghouse Electric & Manufacturing Company, outlined trends of development and sketched progress in electrification of paper-making machines up to the present time, devoting considerable attention to description of paper-making processes. H. W. Rogers, General Electric Company, in a paper on "Development of Sectional Paper-Machine Drive," traced the causes which have led to the adoption of sectional drive for large machines by separate motors as contrasted vith the former practice of driving from a single unit. R. N. Norris, Harland Engineering Company, Canada, discussing "Sectional Drive for Paper Machines," described the interlock system of electric control, giving the power consumption of several mills.

At Friday's sessions (Chester L. Dows, chairman) the scientific phases of refrigeration were to be outlined by Charles F. Kettering, president General Motors Research Corporation, who, it was understood, would compare the problems of household and commercial refrigerators with particular reference to the need of special motors for small machines. G. E. Miller, sales manager Cleveland Electric Illuminating Company, was scheduled to discuss the central station's viewpoint of domestic refrigeration and its possibilities as a load and revenue builder, showing the kilowatt demand, load factor and power factor. Leaving the strictly technical field to show the engineer's part in administration of industry, Past-president Farley Osgood was on the program for an address on "Engineering and Humanity."

The regional dinner on Thursday evening was to be addressed by Newton D. Baker, former Secretary of War, on industrial adjustment. For Friday evening a meeting was scheduled at Nela Park, where Ralph W. Shenton was to describe the organization and objects of that institution and Ward Harrison to outline recent developments in lighting. Inspection of laboratories, exhibits and demonstrations was arranged for, and on Saturday morning special inspection trips for those desiring to visit Cleveland industrial plants were scheduled.

Great Lakes Survey Committee Looks Ahead

Prophesying a consumption of electrical energy in Illinois, Indiana, Michigan, Wisconsin and parts of Minnesota, Iowa, Missouri, Kentucky and Ohio which will reach 54,000,000,000 kw.-hr. in 1950, the power survey committee of the Great Lakes Division of the National Electric Light Association has just issued its report of the power resources of the Middle West. This will mean the genration of about 63,500,000,000 kw.-hr., most of which will continue to be generated by steam power, the report forecasts. It predicts that only from 10 to 20 per cent can be produced from water power, assuming that all potential water-power sites are developed and working at full theoretical capacity during the time of regional peak, "two conditions that are obviously difficult to obtain." About 15 per cent of the present installed capacity (about 4,600,000 kw.) is water power, and although many additional water powers will be developed before 1950, the percentage of water-power capacity may be expected to decrease.

Nearly 100 Foreign Delegates to I. E. C. Now Registered

Ninety-eight delegates, not including ladies accompanying them, have so far informed the general secretary of the International Electrotechnical Commission in London of their intention to attend the conference in New York on April 13 to April 22. Nearly all of them will arrive on the S.S. *Andania*, due April 11 or April 12. The preliminary program and a list (subject to revision and addition) of foreign and American delegates was published in the ELECTRICAL WORLD for March 6 (page 519). John W. Lieb is chairman of the reception committee, Frank W. Smith of the entertainment committee, C. E. Skinner of the tour committee, A. E. Waller of the committee on hotel accommodations, F. R. Low of the publicity committee and H. M. Hobart of the committee on technical sessions. F. V. Magalhaes is secretary of the United States National Committee.

The members of the Canadian National Committee are acting as joint hosts. They are represented by Dr. H. T. Barnes of McGill University, Montreal, and John Murphy of Toronto. A tour of cities in both countries will be made after the conference, those who participate returning to New York on May 5. The cities scheduled to be visited are Philadelphia, Washington, Pittsburgh, Chicago, Detroit, Niagara Falls, Toronto, Ottawa, Montreal, Boston and Schenectady.

Challenges Federal Control

Governor Smith of New York Makes Issue with National Government Over State Water Power

A FURTHER pronouncement in the controversy over New York State water power was made by Governor Smith this week when he issued a long statement in support of his proposed Water Power Authority, which, he explains, would mean the development of water sites and the generation of hydro-electricity by the state under "a contract with an existing private distributing agency or with one to be organized that would take the power at a price sufficient to prove the economic soundness of the plan." The bill now before the Legislature, the Governor points out, provides, first of all, for nothing more than a survey, with instructions to the Power Authority to report a plan to the Governor and the Legislature.

Denying the right of the federal government to put a fifty-year recapture clause in its Niagara River permit or to control development of St. Lawrence power in New York State by means of a treaty with Canada, the Governor says:

"I presume the federal government takes this stand because of the neglect of the State of New York to take any advantage whatever of her own great water-power resources. The creation of a State Water Power Authority will be a challenge to the right of the federal government to assume any ownership or control over water powers now conceded to be the property of the State of New York. And for that reason, if for no other, the Power Authority should be set up at once. The proposed bill confers the power upon the proposed Water Power Authority to represent the state in negotiations with the United States government and the Dominion of Canada to determine and settle the rights of ownership upon the Niagara and St. Lawrence Rivers. Now is the time to settle this question. Positively no harm, and certainly a great deal of good, can come to the state by the setting up of a Water Power Authority. No counter proposal is before the people of the state, and the weakness of the present water-power act was clearly demonstrated at the recent hearing held by the present Water Power Commission of New York State.

"These great resources, now the property of all the people of the state, are threatened in two directions—one by the encoachment of the federal government, and the other by long leases to private corporations. The sensible and reasonable thing to do is to set up the Power Authority and let it prepare a plan, having imposed upon it only the restriction that the buildings, land and machinery required for electrical generation shall remain the property of the people of the state."

Illinois Men in Session

Electrical Progress in State and Nation Depicted—Comprehensive Reports and Good Counsel

THE silver anniversary of the Illinois State Electric Association, coupled with the seventeenth annual meeting of the Illinois Electric Railway Association and the twenty-second annual session of the Illinois Gas Association, brought nearly one thousand public utility operators and managers to Springfield on Wednesday, March 17. A joint session was held in the morning, when J. Paul Clayton, president of the Electric Association, gave an address in which he declared that permanently successful public utility service cannot be rendered without cordial public relations and that utility growth is inseparably linked with the prosperity of the communities served. He also emphasized the utility's responsibility in safeguarding all publicly held preferred stock so that dividends will be regularly forthcoming. Touching on electrical progress, he said that at present there are 7,500 miles of transmission line in Illinois and that it will not be long before these networks will be completely tied together by high-voltage steel-tower lines.

R. V. Prather, secretary of all the organizations, made his annual report, and President J. E. Davidson of the National Electric Light Association talked on "Public Relations Betterment Through Greater Use of Service" and urged every utility to get behind refrigerators, ranges and lamps and to humanize the business by cultivating the good will of customers.

At the session of the Electric Association Prof. E. H. Lehmann of the University of Illinois spoke on the use of electricity in agriculture. Personal service work was discussed by Miss Mabel Miller of the East St. Louis Light & Power Company, and sales organization and development by D. L. Cash of the Rockford Electric Company. Miss Isabell Davie of N.E.L.A. headquarters told of women's work in the utilities. Reports were made for the meter committee by R. D. Hart of the Central Illinois Light Company of Peoria, for the history committee by A. C. Hall of the Illinois Power & Light Corporation and for the rural lines committee by E. F. Kelley of the Central Illinois Public Service Company.

Thursday morning was devoted to the Illinois Committee on Public Utility Information. John F. Gilchrist, chairman of the committee and vice-president Commonwealth Edison Company, gave a summary of the year's activities and the history and purpose of the committee. The report of the committee on co-operation with educational institutions was given by George R. Jones, vice-chairman of committee and secretary-treasurer Public Service Company of Northern Illinois. Keith Spade, Chicago, reported on the Public Service Speakers' Bureau and reports of district organizations of this bureau were made by the chairmen of ten districts.

Miss Theresa Carroll, Springfield, discussed women's place in committee work. "What Is Good Advertising" was the topic of Bernard J. Mullaney, Chicago, vice-president People's Gas Light & Coke Company. J. Paul Clayton, Roy E. Chew and G. F. Egolf, respective presidents of the three associations, discussed the value of state committee work.

At the Electric Association session Thursday afternoon "Storeroom Accounting System," by E. E. Corken of the Central Illinois Light Company, Peoria; "Power Business in Small Towns," by W. D. Hart of the Illinois Northern Utilities Company, Dixon; "Housekeeping," by Frank P. Egan of the Illinois Power & Light Corporation, St. Louis, and "Superpower in Illinois," by R. F. Schuchardt, chairman power survey committee, Great Lakes Division, N.E.L.A., were the topics taken up.

J. F. Gilchrist, speaking at the dinner, declared development and maintenance of good public relations to be the primary problem of utility executives, calling attention also to the problem of obtaining the increasingly great capital needed for development and the consequent need of planning requirements farther ahead. He declared that not enough attention has been given to reducing the cost of getting coal from the earth to the boilers and that more thought on increasing load factor, which is a problem of all business, may offset higher unit costs of plants.

Muscle Shoals Committee Will Push Work

Early Bids to Be Encouraged—Fertilizer Production Versus Distribution of Power Still an Uncertain Issue

BY PAUL WOOTON
Washington Correspondent ELECTRICAL WORLD

EVERY effort is to be made by the joint congressional committee on Muscle Shoals to wind up its work much earlier than April 26, the date on which it is required to report to the Senate.

Following the acceptance by the Senate of the House amendments to the concurrent resolution establishing the joint committee, the Vice-President named Senator Deneen of Illinois, Senator Sackett of Kentucky and Senator Heflin of Alabama as the Senate members of the committee. The Speaker of the House named Representative Morin of Pennsylvania, Representative James of Michigan and Representative Quin of Mississippi. Senator Deneen was elected chairman of the committee and Representative James vice-chairman. W. E. Murray, who served as clerk of the McKenzie Muscle Shoals Commission, was chosen as secretary of the joint committee.

When the amended resolution was sent back to the House from the Senate it was not sent to conference but was brought directly on the floor by the rules committee. The Senate amendments were approved but additional language was inserted. The Senate amendment which provides for more than one lease was objectionable to the House because of the fear that it would result in the recommendation of one lease for the power and one lease for the nitrate plant. The House throughout has opposed the separation of the fertilizer business from the power business. To prevent any such outcome the House voted to add the following: "But no lease or leases shall be recommended which do not guarantee and safeguard the production of nitrates and other fertilizer ingredients, mixed or unmixed, primarily as hereinafter provided."

Under that language it is recognized that the lessee of the surplus power would have to guarantee fertilizer production. Some believe this would interfere with, if not prevent, the distribution of such power as was not needed for nitrate or fertilizer production. While there is no opposition to a stipulation that fertilizer manufacture is to have the first call on the power, there are many senators who will not agree to any plan under which fertilizer production is subsidized with power. They are willing to make any lease for power conditional upon the recall of the power when needed for fertilizer production, but most of the Southern senators, at least, are convinced that unsubsidized fertilizer manufacture cannot live at Muscle Shoals under the present state of the art of fixing nitrogen.

The joint committee on Muscle Shoals held a meeting Wednesday afternoon, at which time Dr. R. O. E. Davis and Dr. William H. Ross of the Department of Agriculture appeared. Dr. F. G. Cottrell, director of the Fixed Nitrogen Research Laboratory, appeared before the committee Thursday. The committee invites all interested individuals, firms or corporations to prepare forthwith and submit bids for all or any part of the government property at Muscle Shoals. In view of the short time given the committee in which to file its report and of the time required for the negotiation of the terms and the preparing of a lease and drafting of appropriate legislation after the selection of the bid which the committee may favor for submission to the Congress, the committee requests that any and all bids be submitted at the earliest possible moment and be addressed to the secretary of the joint committee on Muscle Shoals, at the Capitol, Washington, D. C.

Fritz Medal to Be Bestowed on E. D. Adams March 30

Edward Dean Adams, engineer, financier and scientist, "whose vision, courage and industry made possible at Niagara Falls the birth of hydro-electric power," will, it is announced by the Engineering Foundation, receive the John Fritz gold medal at a national gathering in the Engineering Societies Building, New York City, on Tuesday evening, March 30. Frank B. Jewett, chairman of the board of award and past-president of the American Institute of Electrical Engineers, will preside, and the speakers will include

James M. Beck, former Solicitor-General of the United States; Dr. A. E. Kennelly, professor of electrical engineering at Harvard University and Massachusetts Institute of Technology; Fred J. Miller, past-president of the American Society of Mechanical Engineers, and Mr. Adams. The four major engineering societies will participate in the event.

Ferguson Decries Speculative Financing

President Hartford Electric Light Company Attacks Practice of Overcapitalizing Prospective Gains from Interconnection —Conservative Development Essential

VIGOROUSLY condemning speculative banking in connection with electric power pooling, President Samuel Ferguson of the Hartford Electric Light Company addressed the Connecticut Section, A. I. E. E., last week in Hartford and cited the wholesome results of the so-called Connecticut Valley power exchange, which has been operating about a year between the systems of the Hartford, Springfield and Turners Falls companies.

"The term 'power pool,'" said Mr. Ferguson, "is a rather loose one, meant to cover the unified operations of comprehensive systems for the manufacture and transmission of electric power free from any limitations resulting from the diverse ownership of any of the constituent parts. It is in one way a rather unfortunate term since it brings to the lay mind the picture of a minority strongly organized in opposition to an unorganized majority, whereas such an interpretation has no place in the engineering picture. Perhaps, however, it is just as well that it has been generally applied so that the country will have its eyes open in case speculative bankers should make an attempt to use this very useful engineering concept in the generally accepted sense that is attached to stock market pools, namely, by concerted minority action to force security values to high levels and then unload on others. The stigma of the name may slow up developments, but at least we avoid the risk of finding that questionable practices have been perpetrated under a euphonious title. . . .

"The engineering solution is so simple that may people are beginning to wonder at the delay in reaching a practical solution. If all the facilities were owned by one company, there certainly would be no further delay beyond that required to finance and construct the necessary lines, but because of diverse ownership there are many problems of equity which must be worked out before the job can be completed. The complexity of these problems in equity as between companies, together with the very real and large savings to be effected, is the reason why many companies have endeavored to simplify the matter by creating a common ownership embracing larger stretches of territory than are included in the franchises of each. The fact that there are large prospective savings makes these mergers and consolidations relatively easy to consummate, because if the prospective savings are capitalized in the corporate structure of the consolidated or holding company, to each present stockholder a sufficiently high price in cash or securities can be given to compensate him completely for the possible future equities in the stock he gives up.

"This is without question one method of hastening the process of evolution and one which, if not abused, is very desirable. But the question arises at once, 'What is the value of the economies to the communities if in order to effect them it has been necessary to capitalize the savings for years to come, and in their capitalized form to donate them either to the former stockholders or to the speculative banker who has brought the parties together?' Obviously, the advantages are not mutual in such a case, and as the public utility business is in effect a partnership between capital and the public, I view such action in exactly the same light as I would a transaction in any other line of business partnership in case one partner should take all the profits from a joint transaction. On the other hand, I would think it equally inequitable if either of the other partners should insist that the whole of the benefits should accrue to him as might be the case if certain men who think utilities are wholly evil should be able to create sufficient public sentiment to enact injurious legislation. There must be found some middle ground, because it is wholly unjust to capitalize all the economies in sight, and it is only a sophistry to point out that, even so, prices for power and light will be lowered.

"In some mergers effected the benfits have been very largely given to the public, but in some there is no doubt that the promoter has retained all and more than his share. Mergers and consolidations are in themselves a vehicle for very great good to both partners, but, like many useful things in nature, when misused, they are liable to become instrumentalities for evil. I know of no more reprehensible abuse than for speculators to buy up companies for high prices, put them into a holding company, and then, by trading on the credulity of the investing public relative to claimed increases in economy, to unload the holding company's securities at advanced prices and thus get completely out from under before the bubble is punctured, leaving the unfortunate final investor to face an angry consumer. In the interest of all, this possible abuse must not be permitted, and signs of recognition of the need for effective co-operation between state regulating bodies are at present in evidence. . . . There should be permitted an equal division of the benefits of interconnection and centralization, but the partner that represents the public should make the still further development of the business look so attractive to the partner that represents capital that the latter will allow his share of the profits to remain in the business and thus still further increase the benefit to both."

Power and Industry

Southern Mining Congress Discusses the Relation of Fuel and Water Power to Manufacturing

BEFORE an industrial development conference held by the Southern Division of the American Mining Conference at Memphis this week there was an enlightening discussion of the relation of the great fuel supply of the South and its unexcelled water powers to the fabrication of its raw materials into finished products. Two hundred delegates, representing states from Virginia to Texas, attended the conference. The closest co-operation with the electric light and power industry was urged. B. E. Eaton, president Mississippi Power Company, said that electricity would eventually be the only source of industrial power, steam plants supplying energy from strategical sites in conjunction with water power. Other speakers dwelt on related industrial questions.

Asserting that the South has led the nation in electrical development during the last five years, Managing Director M. H. Aylesworth of the National Electric Light Association, speaking on "Industrial Expansion Through Electrification," said that the American laboring man has an average of four horsepower at his elbow, and that this is the answer to those of foreign countries who wonder at industrial progress in this country. He pointed out that less than 4 per cent of the electrical output is produced by municipally owned and operated electrical plants and that the interconnection of company systems has had much to do with the ability of the electric light and power industry to furnish an uninterrupted supply of low-cost energy in the face of repeated increases in the cost of land, labor, fuel and taxes.

POWER TRUST BUGABOO

"Interconnections, consolidations and mergers in the interests of efficiency, economy and better service to the public naturally have led to some misapprehension," continued Mr. Aylesworth. "Some have claimed that there is a 'power trust' in existence; others that the merging of small plants into large systems will result in an unwieldy and uncontrollable 'big business.' A country-wide survey which has just been completed shows that in addition to several thousand small isolated electric plants there are approximately three hundred company systems serving territories of 25,000 or more population each. This survey shows that the first twenty operating companies in size, having approximately one-half of the output, owing to the largeness of the companies and the congestion of population in the centers served by most of these companies, are in every respect separate and distinct in ownership and management. The next one hundred operating companies in size have an average company output of about one-half of 1 per cent of the national output. No holding company or management company, so-called, has through its subsidiary operating companies, no matter how affiliated, an output of kilowatt-hours exceeding 7 per cent of the national output."

Complications at Denver

Public Service Franchise Expires in May and Municipal Hydro Plant Advocates Are Busy

OFFICIAL announcement has been made by the Public Service Company of Colorado that it will seek a new franchise in Denver when the one it now holds expires on May 15. It will be remembered that when the company submitted a new franchise at the regular spring election last May it was defeated, and since that time it has not been known whether the company would apply for another franchise or would ask for an indeterminate permit.

Clare N. Stannard, vice-president and general manager of the company, has now anounced that it is the intention of the company to consult with the city authorities and representative business organizations in the formulation of any plan entertained. Herbert D. Dwight, electrical engineer of the Colorado Public Utilities Commission, has, on the recommendation of Secretary Hoover, been loaned to the city for expert services in establishing the valuation of the Public Service Company as the basis for rates to be incorporated in the new franchise proposition.

A movement has been started proposing a change in the city charter, substituting an alleged city-manager form of government for the present form, with the creation of a public utilities commission which would be supreme in dealing with the privately owned utilities operating in the city. Petitions for the change in the city charter are being circulated. One phase of the situation as it affects the franchise renewal of the Public Service Company is the desire of the supporters of the charter amendment to submit it at a special franchise election, the expense of which must be borne by the company, thus complicating the issues.

A proposal for the construction of a seventeen-and-one-half-million dollar municipally owned and operated hydro-electric plant in conjunction with the proposed municipal waterworks at Two Forks on the South Platte River has been presented to the city authorities. This is the first injection of the municipal ownership idea into the Denver situation and marks the culmination of recent developments of this character Colorado, notably in Loveland and Colorado Springs. Reports indicate that the same financial interests and engineers active in those conversions are behind the Denver project. If the plan is approved by the city, it is thought that one of two things will be attempted—either to force the Public Service Company or some other company to contract for the purchase of all energy generated or, failing in this, to launch the city into every phase of the electrical business.

Outside of the construction required at the dam site for water purposes, no financial obligations are, under the terms of the offer, to be assumed by the city. Income warrants representing obligations against earnings rather than invested capital would be accepted in payment for the hydro-electric construction, estimated to cost about $12,500,000.

A delegation of retail merchants recently called on the Mayor and asked his assistance to have included in the new franchise for the Public Service Company a provision forbidding it from merchandising, an activity in which the company has been a pioneer. This action, it is reported, is in retaliation for the recent selling campaigns of the company, especially in lamps and radio equipment.

British Workmen Visit Electric Power Houses

PLANTS of the New York Edison and United Electric Light & Power companies, including Hell Gate and the great power house now under way on East Fourteenth Street, were among the first to be visited by a delegation of British workmen now in America as guests of the London *Daily Mail*. John W. Lieb, vice-president of the first-named company, greeted the delegation. Left to right in the picture are Fenton MacPherson of the *Daily Mail*, Vice-president Thomas E. Murray, designer of the East Fourteenth Street plant, and William Mosses, secretary of the British Federation of Engineering and Shipbuilding Trades. Messrs MacPherson and Mosses are in charge of the visiting party, which posed in groups for the New York Edison photographers.

Oklahoma Utilities Satisfied with Revocable Franchise

Resolutions reaffirming support of the revocable permit law enacted by the Oklahoma Legislature in 1925 were passed on the last day of the convention of the Oklahoma Utilities Association at Tulsa last week, of which the main features and earlier sessions were reported in the March 13 issue of the ELECTRICAL WORLD. The resolutions asserted that since passage of this law more franchises by nearly 300 per cent have been voted by Oklahoma municipalities than during any like period of time in the history of the state and that no bad effects from the public's viewpoint have been found. It was declared that operation of the law has brought improved quality and enlarged scope for utility service and that financing has been easier and at lower cost.

Other events at the concluding session were the report of the manager of the association, E. F. McKay, and a report on speakers' bureau activities by O. D. Hall, assistant manager. Speakers were furnished by the convention for every civic and business organization which met or held noon-day luncheons in Tulsa during the three days it lasted. Officers elected were: President, J. A. Frates, Tulsa, vice-president Oklahoma Union Railway Company; first vice-president, James H. Buell, Oklahoma Power Company, Tulsa; second vice-president, L. W. Scherer, Yale. W. R. Emerson, Oklahoma City, was re-elected treasurer and E. F. McKay, Oklahoma City, manager. Earl R. Ernsberger, Oklahoma City, will be the new chairman of the Electric Light and Power Division.

Oil City Now Interconnected

Tie with Penn Public Service Rushed Through to Help Flooded Pennsylvania Plant

AS A DIRECT outcome of the flooding of the power house at Oil City, Pa., serving that city and Franklin, as told last week, the Citizens' Light & Power Company of Oil City rushed to completion a connection with the transmission lines of the Penn Public Service Company, and energy was transmitted over the new route on Friday morning, March 12, permitting complete resumption of service. This was the first time that outside electric power had ever been turned into the Oil City distribution system, and the accomplishment, which is expected henceforth to make the communities served independent of plant shutdowns caused by Allegheny River floods, was the cause of much local satisfaction. The tie-in was made in record time through the strenuous efforts of the electrical forces of both companies. When the emergency shall have entirely passed, temporary construction is to be replaced by a permanent interconnection.

Physical connection of the lines of the two companies was made at Cherrytree, on the McKinley Highway, where the Titusville-Oil City and Erie-Clarion lines of the companies cross. It was necessary to employ three transformers weighing 35 tons each to step down the voltage of 110,000 to 23,000, and to clear bridges these transformers had to be detoured over circuitous railroad routes. They were unloaded at Petroleum Center, where an outdoor substation was constructed, and thence a 3-mile line was strung back over the high wooden towers of the Penn Public Service Company to Cherrytree. The West Penn Power Company, operating in Pittsburgh, lent the transformers, and employees of this company worked night and day to get them ready for shipment. Other necessary equipment was assembled from various directions and eighty-six barrels of transformer oil were shipped by truck from Connellsville.

Purchases and Mergers

General Gas & Electric's Pennsylvania Properties Consolidated—More Municipal Plants Bought

MERGER of the Hanover Power Company, the Gettysburg Electric Company and the Cumberland Valley Light & Power Company with the Metropolitan Edison Company of Reading, the chief subsidiary of the General Gas & Electric Corporation, was announced last Tuesday, following approval by the Pennsylvania Public Service Commission. The first three companies supply electric service to York, Adams and Cumberland Counties in southern Pennsylvania. The Hanover Power and the Gettysburg Electric were purchased by the Metropolitan Edison in 1923 and the Cumberland Valley Light & Power was acquired in 1924. The merger will not change present operating plans.

The territory that is served by the Wisconsin Power & Light Company has again been widened to include the towns of Scandinavia and Iola, where it has purchased the electric system of the Scandinavia Light & Power Company and the generating and distribution system of the Iola Light, Power & Manufacturing Company, which has been generating and purchasing its energy requirements.

The Iowa Light & Power Company has purchased the Marion County (Iowa) Electric Company of Knoxville from Herbert and Earl B. Bellamy. The Marion plant has not been operated for the last six years.

The Otter Tail Power Company has bought six North Dakota plants, situated at Walla Walla, Minto, Ardock, Fordville, Lankin and Adams.

The Lincoln (Ill.) Water & Light Company has contracted for the purchase of the electric plant at San Jose, Mason County, from Frank E. Hullinger, for $37,500.

The Central Illinois Public Service Company has filed application for permission to purchase the municipal electric light plants at Divernon and Creal Springs.

Controlling interest in the Richmond (Ind.) Light, Heat & Power Company, subsidiary of the United Gas & Electric Company of New York, has been acquired by the E. I. Phillips interests, according to word received in Indianapolis from Richmond.

The Pea River Power Company and the River Falls Power Company have together organized the Opp Light & Power Company to serve Opp, Ala., ending a quarrel over territory.

The Tennessee Railroad and Public Utilities Commission has approved of the purchase of the Sequatchie Valley Power & Light Company by the Southern Cities Power Company.

W. G. Swenson of Abilene, Tex., has purchased the electric light and power plant of the Citizens' Light & Power Company of Fredericksburg, Tex., for a consideration of $190,000.

Besides recent purchase of the electric light and power plant at Sabinal, the Texas Central Power Company has added to its holdings during the past few weeks similar plants at Cotulla, Goliad, Hebronville, Schulenburg and Three Rivers, Tex.

The Continental Light & Power Company has purchased the municipal electric light plant at St. Jo, Tex.

An offer has been made by the Texas Power & Light Company of Dallas to the Nacogdoches City Council to purchase the municipal electric light and power plant for $150,000, including a 50-year franchise. The proposition has been referred to the citizens.

The Puget Sound Power & Light Company has taken over the Avery Public Utilities Company of Avery, Wash., the People's Utility Company of Rochester, Wash., and the municipal light and power system of Oakville, Wash.

The Quebec Southern Power Corporation has, through its subsidiary, the Laurentian Hydro-Electric Company, acquired the municipal plant at St. Jerome in the Province of Quebec, subject to ratification by municipal bylaw.

The New York Public Service Commission has consented to the transfer of the North Creek Electric Company, operating in the town of Johnsburg, to the Adirondack Power & Light Corporation. The purchase price is $55,000.

Governor Hunt Talks to "Electrical World"

Chief Executive of Arizona Explains State's Stand on Colorado River Development—He Hopes for Agreement on Part of Three Lower Basin Commonwealths

DETERMINED opposition led by Governor George W. P. Hunt has so far not only prevented Arizona from ratifying the seven-state treaty on the Colorado River negotiated more than three years ago, but has acted as an obstacle to any development of that stream. The reasons for Arizona's stand have been stated at length more than once in the ELECTRICAL WORLD. Their latest expression, however, is contained in the following utterance of Governor Hunt, made recently to a representative of the ELECTRICAL WORLD who called upon him at Phoenix:

"Arizona," said the Governor, "has endeavored since October, 1923, to bring about adoption of a supplemental compact between California, Nevada and Arizona to protect the interests of each state in the lower basin of the Colorado River. California was unwilling to enter into any negotiations whatever until August, 1925, and was then not willing to negotiate until Arizona specifically withdrew any objections she had to the construction of a dam at Boulder Canyon. The failure of Arizona to agree to such an arbitrary requirement caused the failure of the negotiations.

"On Dec. 1, 1925, the California-Nevada committee submitted a proposal to Arizona which, when analyzed, allocated three parts of the water to California to one part for Arizona; or, in other words, California would keep all water she is now using, permit Arizona to keep the water of her own streams, the major portion of which she is now using, in exchange for which California would receive 1,095,000 acre-ft. of water for Los Angeles and then divide the remainder of the water, if there were any left, fifty-fifty between California and Arizona. In addition, California offered, if Arizona would agree to the construction of a dam and power plant at Boulder Canyon, to pay a tax of one dollar a year per installed horsepower.

"This proposal was obviously unjust to Arizona and was universally rejected by the people of the state. The Arizona committee, appointed by myself, then submitted a counter proposal which is predicated upon the theory that each state in the Colorado River basin is entitled to the use of all water that falls within that state that can be put to economic and beneficial use, and that the surplus of water which goes to the lower basin states from the upper basin would be allocated at Lee's Ferry, first giving Nevada what she asked for in her own proposal—i.e., 300,000 acre-ft. per annum—and, second, dividing the remainder equally between California and Arizona. The present perfected rights in each state can and are to be satisfied from the water allocated to each state. It is also proposed that each state would be entitled to the benefit from power developed in that state, and that where the power is developed on the border of each state it shall be divided. The California committee did not accept the date suggested by Arizona for the consideration of both proposals, and since Secretary Work made his proposal California has made no effort to arrange a conference.

"We look upon the so-called Work-Hoover proposal as another effort on the part of the federal government to invade the state's rights and an attempt not only to coerce Arizona into the signing of the compact, but to go further and deny her control of the development of her water and power. Furthermore, this proposal absolutely ignores all fundamental and basic water law in the Western States and cannot possibly be accepted by Arizona as a solution of the Colorado River problem.

"The board of directors of State Institutions of Arizona has made application to the Federal Power Commission for a permit to construct a dam at Bridge Canyon, a site wholly within the State of Arizona, where there is capable of development as much or more power than can be developed at Boulder Canyon, and without asking any appropriation from Congress to build it. In addition to being useful for power purposes, a dam at this point has been declared to be ideal for diversion of water to irrigate Arizona lands and also to provide a gravity system of water supply to the cities of southern California. Arizona would be quite content if permitted to proceed with such a project.

"We are hopeful that Arizona, California and Nevada may soon come to some agreement, because, in spite of state lines, we are an economic unit, and early development of the Colorado River is essential to the welfare of the Southwest. Following such agreement

between the lower basin states there should be no difficulty encountered in satisfying the rights and requirements of the upper basin states. Arizona is willing to give the upper basin states the protection asked for in the Colorado River compact, but denies any additional rights of the upper basin states to revenue from power that may be developed in the lower basin. All that Arizona asks is that she be given a fair break, and we do not feel that any of the proposals thus far made have done this."

Hoover for Colorado Bill

Thinks that Amended Swing-Johnson Measure Meets Conditions and Hopes Arizona Will Agree

APPEARING before the House committee on irrigation and reclamation March 3, Secretary of Commerce Hoover dwelt on the urgency of the Colorado River situation and advocated the passage of the amended Swing-Johnson bill now before Congress, which provides for governmental financing to build a dam at Boulder Canyon. Alluding to the opposition of Arizona, Secretary Hoover said:

"There remains practically only the outstanding conflict of major importance—that of the State of Arizona refusing to accept the compact and wishing to make acceptance conditional on prior agreement on various questions with the States of California and Nevada. I have felt that the public interest of the people involved is so great that the whole of this enormous work should not be held up because of this last remaining fraction of opposition. I believe Arizona is amply protected under the compact. Our proposals meet 90 per cent of all this mass of conflicting views. I feel that this opposition so far as water rights are concerned arises out of a miscalculation as to the resources of the Colorado River. Certainly for all practical development that could be undertaken within the next 75 years there is more water than can be used by the whole of the seven states. The Colorado River compact allots approximately 60 per cent of the water. Forty per cent of it, as provided in the compact, can be reallocated at the end of 40 years. There is ample provision, therefore, for readjustment in the respective rights of the different states based upon the merits at that time. It seems to me almost fantastical to be fighting the shadows of what may happen under these circumstances 75 years hence. We can trust to the generation after the next to be as intelligent as we are today. They will settle it in the light of the forces of their day."

Advocating that leases for power development on the Colorado should fall under the jurisdiction of the Federal Power Commission, Mr. Hoover went on to say:

"I have no sympathy with the federal government going into the power business. In this case our dominant purpose is flood control, irrigation and domestic water. Power is a byproduct, and we should sell it on such terms as will recover with the sale of water the governmental outlay. It should be licensed as water to people who will construct the electrical works, if possible, but if this is impossible, we should do no more than lease the power plant over the term of years provided. I believe that the various parties interested, the municipalities, the private power companies, etc., could be brought together on the first proposition when the Secretary of the Interior has authority to do so.

"Another question that seems to me could be widened out a little is that provision would need to be made for the use of some of the power by the States of Arizona and Nevada, and this might be done by those states entering some undertakings with the people who might erect the power equipment in the meantime."

Upper Basin States Hope for Early Colorado Agreement

"The situation is more hopeful today for an amicable settlement of the differences of opinion on the Colorado River question than at any time since the Santa Fé compact was drawn," said L. Ward Bannister to a representative of the ELECTRICAL WORLD in Denver recently. As president of the Denver Chamber of Commerce, president of the Colorado River League and special counsel for the city of Denver in water matters, Mr. Bannister speaks with an intimate knowledge of the position of the upper basin states.

"We are absolutely opposed," he said, "to any federal or other development in the lower basin except under the following conditions: First, that the seven-state compact be ratified, or, second, that a six-state compact be ratified after Arizona has refused a reasonable offer on the part of California and Nevada for a three-state compact, and that the proposed Boulder Canyon development be confined as to its power and water benefits to those six states that ratify the compact. We are forced to take this position to protect our interests in the use of water, and under the compact we are protected because a certain proportion of the water is specifically set aside for the use of the upper basin states.

"It would not be right for federal money, which is in part the money of the upper states, to be used to further projects in the lower states unless assurance be given by some such medium as the Colorado River compact that there would still be left a residuum of water for the use of the upper states free and clear of all water priorities in any wise connected with the federal project. It is hard for us of the upper states to understand why any of the lower states should feel that there must be an agreement among themselves before making an agreement with the upper states. Here in the upper states there has already been one subordinate interstate compact made between New Mexico and Colorado in respect to one of the tributaries of the Colorado River. This subordinate compact was made without first requiring the upper states and the lower states to sign the Colorado River compact. Arizona and California under the mediation of Nevada are trying earnestly to get together. Our hope is that they will succeed, for then we believe that ratification of the main compact will follow.

"Meanwhile I feel that we of the upper states must modify somewhat our attitude toward the Boulder Canyon project. Hitherto we have been opposing it because the proponents of the compact have not given us the requisite assurances for our own protection. The Work-Hoover proposal contains the element of protection required in its requisite that the 'benefits' of the project be confined to the ratifying states. It would seem the part of wisdom for the upper states to work out in their behalf the details of the protection suggested by the proposal and after having done so to turn in and assist Secretaries Work and Hoover in translating their proposal into accomplishment."

Briefer News

Aurora (Ill.) Plant to Be Doubled.—The capacity of the Western United Gas & Electric Company's plant at Aurora, Ill., now rated at 21,000 kw., is to be increased this year by the installation of a 22,500-kw. unit, and a third generator of equal size is planned for the future. The cost of this year's expansion will be $4,000,000. Ten thousand customers in the Fox River Valley were added last year. The company is now under the control of the Fitkin Utilities, Inc.

Construction Budget of Baltimore Company for 1926.—The electrical construction plans for 1926 of the Consolidated Gas, Electric Light & Power Company of Baltimore include a new generating station to be built in the southern section of the city, which, with other expenditures for equipment in the existing power plants, will cost $2,871,500; expenditures on land, structures and equipment for substations, $808,200; transmission and distribution systems, $1,956,500, and miscellaneous expenditures, $46,600, making a total expenditure on electrical construction of $5,683,000, or, with gas and general expenditures added, of $7,455,000.

Company Sues City for Failure to Buy Former's Lighting System.—An action to recover $192,256 for alleged breach of contract in failing to buy from the Northern New York Utilities, Inc., its street-lighting equipment has been started against the city of Watertown, N. Y., by the company named, which says that, in disregard of contract provisions binding the city to buy the company's equipment in case the contract were not renewed, the city has announced a decision to build an entirely new system. The city claims that the provision on which the company relied was valid only during the life of the contract, which has expired.

Another Michigan Municipal Plant to Go on Consumers Power Lines.—By a vote of 512 to 23, the people of Reed City, Mich., on March 8 voted to sell the city's municipal lighting plant to the Consumers Power Company and approved a franchise for the company. The municipal plant is a small water-

power property and two Diesel engines. Reed City is between Cadillac and Big Rapids, two cities which long have been served from the company's system, and under the terms of the contract Reed City will be tied into this system by construction of a line from Big Rapids. The company will apply its standard rates, which means a decrease in the cost of electricity in the community of from 20 to 40 per cent.

New England N. E. L. A. to Convene in Maine.—The eighteenth annual convention of the New England Division, N. E. L. A., will be held at the Poland Spring House, South Poland, Me.. on Sept. 21 to Sept. 23.

Irrigation District Would Dam Sacramento and Sell Power.—Tentative plans have been filed with the California Division of Water Rights by the Glenn-Colusa Irrigation District for the building of a gravity diversion dam across the Sacramento River near Hamilton City, Glenn County, this taking 3,000 cu.ft. per second for irrigation and power purposes. The scheme is to substitute a gravity irrigation system for the present pumping plant. The estimated cost of the project is $2,000,000. including a power house, where 8,000 actual horsepower could be generated, which it is hoped to sell to a distributing company for a sum which would pay most of the operating expenses of the irrigation district. Permission from the federal government will be necessary.

Spray Lakes Hydro Scheme Would Cost $14,000,000.—The government of the Canadian Province of Alberta adopted a resolution on March 10 calling upon the Dominion Parliament to make provision immediately for the granting of the necessary license to permit development of the water-power site at Spray Lakes in that province. According to a recent report of F. A. Gaby, chief engineer of the Ontario Hydro-Electric Power Commission, and associates retained by the Alberta government to investigate the Spray Lakes development, the main project would cost $14,352,206. The development would supply power to Calgary, Edmonton and 23 other municipalities. The proposal, as submitted by Mr. Gaby and his associates, provides for the complete development of what is known as No. 1 plant of the Spray development. No. 2 development is to be deferred until some undetermined future date, when power requirements would justify its development.

Hagerstown (Md.) Is Enjoined from Issuing Bonds for Power Plant.—The Maryland Court of Appeals has decided that the city of Hagerstown must, after four years' litigation, comply with provisions of the Public Service Commission law before it can float a bond issue for $300.000 for the erection of a new power plant. Such an issue had been approved by the voters, and when it was once before overruled by the courts an enabling act was passed by the Legislature exempting cities with populations of more than 20,000 and a taxable basis of at least $15,000,000 from certain provisions of the Public Service act. This act is now declared unconstitutional, in opposition to the ruling of the lower court. City officials say the plant will be built, notwithstanding, profits from the present plant being almost sufficient, with the surplus on hand, to meet the cost.

Agreement Reached on Grand Falls (N. B.) Hydro Plans?—It is reported from St. John, New Brunswick, that an agreement with regard to power development at Grand Falls has been reached between the provincial government, the International Pulp & Paper Company, Ltd., and Frasers Limited. With respect to this agreement Premier Baxter is reported to have said: "It is the business of this government to get industry started in this province and to help in launching a development which probably will run into an expenditure of from $25,000,000 to $40,000,000, besides securing constant employment for several thousands of men."

Water-Power Project for Skykomish River. — Seeking title to water and reservoir rights in the Cascade Mountains, near Skykomish, Wash., where the development of a hydro-electric project to cost $1,300,000 is contemplated, W. T. Batcheller and E. A. Olson of Seattle have filed a series of three applications with the State Hydraulics Office. This venture, on which development is to be started prior to Jan. 1, 1929, includes two plants to be built on the West Fork of the Miller River, a tributary of the Skykomish River, and to produce a total output of 10,300 continuous electrical horsepower. The water appropriation asked is 260 cu.ft. per second, and a reservoir storing 45,000 acre-feet of water will be constructed at Dorothy Lake, with a concrete dam 100 ft. high.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 2, page 80.]

Arkansas Utilities Association—Hotel Marion, Little Rock, March 29-30. R. I. Brown, Arkansas Central Power Co., Little Rock.

Middle West Division (and Iowa Section), N. E. L. A.—Fort Des Moines Hotel, Des Moines, April 7-9. H. M. Davis, Fraternity Bldg., Lincoln, Neb.

Southwestern Public Service Association—Galveston, Tex., April 13-16. E. N. Willis, 403 Slaughter Bldg., Dallas.

Southwestern Division, N. E. L. A.—Galveston, Tex., April 13-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio.

International Electrotechnical Commission—Engineering Societies Bldg., New York, April 13-22.

American Welding Society—New York, April 21-23. M. M. Kelly, 29 West 39th St., New York.

American Electrochemical Society—Chicago Beach Hotel, Chicago, April 22-24. C. G. Fink, Columbia University, New York.

Southeastern Water and Light Association—Hotel Casa Marina, Jacksonville Beach, Fla., April 27-29. W. F. Stieglitz, Columbia, S. C.

Southeastern Division, N. E. L. A.—Pinehurst, N. C., April 27-29. C. M. Kilian, 317 Hurt Bldg., Atlanta.

Nebraska Section, N. E. L. A.—Lincoln, April 29-30. H. M. Davis, Fraternity Bldg., Lincoln.

Missouri Association of Public Utilities—Springfield, Mo., May 2-4. F. D. Beardslee, 315 North 12th St., St. Louis.

American Institute of Electrical Engineers — Regional meetings: Madison, Wis., May 6-7, and Niagara Falls, N. Y., May 26-28. F. L. Hutchinson, 33 West 39th St., New York.

Electrical Manufacturers' Club — Hot Springs, Va., May 12-15. W. F. Field, Safety Cable Co., New York.

National Electric Light Association—Atlantic City, N. J., May 17-21. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club—The Homestead, Hot Springs, Va., May 24-27. S. N. Clarkson, Keith Bldg., Cleveland.

Camp Co-operation VI.—The dates for Camp Co-operation VI, the fifth conference of representatives of electrical leagues and others interested in local co-operative work for business development, have been set for Sept. 1-4, inclusive, at Association Island, Henderson Harbor, N. Y. Meetings of the League Council, the Advisory Publicity Council and special committees will be held on Aug. 30 and 31. These conferences, initiated in 1922 by the Society for Electrical Development, reached a high point in 1925, when representatives from 67 local and 12 national organizations were present. The society asks that leagues, which should insist on being represented, notify it promptly at 522 Fifth Avenue, New York, in order that invitations may be extended.

New Birmingham Hydro-Electric Company Ready to Go Ahead.—The People's Hydro-Electric Power Company of Birmingham is starting boring tests for its proposed million-dollar hydro-electric development at Lock No. 2 on the Coosa River, according to R. H. Cobb, president. The company, which was organized three years ago to take over the Coosa River properties of the Old Coosa River Electric Company, has a certificate from the Alabama Public Service Commission and a preliminary permit issued by the Federal Power Commission. The latter body, however, expressed some doubt of the feasibility of the company's plans (see ELECTRICAL WORLD for June 6, page 1220). The site is said to be strategically located for supplying power to Gadsden and Anniston, and the company plans to build a 45,000-hp. generating plant.

Taunton Tie-in to Be Further Investigated.—Failure of the Massachusetts Legislature to act favorably on the bill to allow the city of Taunton to borrow $100,000 outside the debt limit to enlarge the municipal lighting plant will lead to further consideration of the problem of future power supply by the city authorities. Revised offers designed to make the purchase of at least a part of the community's needs more attractive have been submitted by the Edison Electric Illuminating Company of Brockton, which is now interconnected with the Montaup station near Fall River; by the Narragansett Electric Lighting Company, Providence, and by the Eastern Massachusetts Street Railway. It is expected that these proposals and the possibility of undertaking an initial extension of the Taunton plant from available funds will be discussed at an early meeting of the

Municipal Lighting Commission with Jackson & Moreland of Boston, consulting engineers to the city.

Progress in Texas.—In the use of electric service for power and light Texas advanced from fifteenth place among the states in 1924 to thirteenth in 1925, according to the Texas Public Service Information Bureau. The 1925 figures will seem small, however, as compared with the showing to be made this year. Among the power projects to be completed in 1926 are the generating stations of the Texas Public Utilities Company at Trinidad in the lignite coal fields, of the Eastern Texas Electric Company near Beaumont and of the Comal Power Company at New Braunfels, while large generating units are under consideration by the Texas Central Power Company and the West Texas Utilities Company. Interconnection of transmission lines is proceeding so fast that 1926 may see three-fourths of the generating capacity of the state, despite its immense territory, linked together. Output of energy in Texas in 1925 was 1,252,000,000 kw.-hr. More than 900 miles of transmission line was built.

Another Expansion Program for Florida Properties.—Plans for 1926 extensions in Florida adopted by the Florida Power & Light Company and the Florida Power Corporation were noted last week (page 572). In addition to these, the Florida Public Service Company, which is controlled by the General Gas & Electric Corporation, has just announced that its expenditure for expansion in central Florida this year will total more than $4,000,000. Of this amount $2,000,000 will be expended on a new steam plant at Benson Springs, on Lake Monroe, similar to the one operated at Parr Shoals, S. C., by the Broad River Power Company, also a General Gas & Electric subsidiary. The first 12,500-kw. unit at this plant will, it is expected, be in operation before September. From Benson Springs a 110,000-volt line will be constructed to the company's most southerly plant—that at Lake Wales, 150 miles distant, at a cost of $2,000,000.

British Columbia Company Organizes Subsidiary with Shares in Dollar Currency.—The British Columbia Electric Power & Gas Company, a subsidiary of the British Columbia Electric Railway Company, has been incorporated in the Province of British Columbia for the purpose of permitting customer ownership to be realized. It will take over the capital stock of the Vancouver Power Company, the Vancouver Island Power Company, the Western Power Company, the Burrard Power Company, the Bridge River Power Company, the Vancouver Gas Company, the Victoria Gas Company, the British Columbia Gas Company and the British Columbia Rapid Transit Company. This capital stock, amounting in value to more than $15,000,000, has been held in the past by the railway company. The British Columbia Electric Railway Company is an English company, and as such its capital is in pounds sterling and its dividends are subject to English income tax. It has never been feasible to sell its stock or shares in British Columbia for these reasons.

Men of the Industry

H. W. Peck Now in Chicago

Henry W. Peck, formerly vice-president of the Adirondack Power & Light Corporation, Schenectady, has been placed in charge of the Chicago office of the General Engineering & Management Corporation with local supervision of the Western properties managed by that corporation. Mr. Peck had been affiliated with electrical utilities in Schenectady since 1912, when he became vice-president and general manager of the Schenectady Illuminating Company and the Mohawk Gas Company, holding the same position with the Mohawk Edison Company, the successor company. After the company became the Adirondack Power & Light Company he acted as vice-president and resident manager at Schenectady until 1921, when he was relieved of the duties of resident manager to engage in special work for the company, retaining, however, the office of vice-president. Mr. Peck's previous connections include the Westinghouse Electric & Manufacturing Company, the Consolidated Gas, Electric Light & Power Company of Baltimore and the Rochester (N. Y.) Railway & Light Company. Mr. Peck has been actively associated with the representative electrical societies, being a fellow of the American Institute of Electrical Engineers and a past-president of the Empire State Gas & Electric Association.

C. S. Ruffner Heads Adirondack Company

Charles S. Ruffner, formerly vice-president and general manager of the Adirondack Power & Light Corporation, was elected president of that organization at the recent annual meeting of the board of directors. Mr. Ruffner has been a prominent figure in the electrical industry for more than twenty years, at first in the Middle West and more recently in the Empire State, whither he removed in 1919. It was largely due to his efforts that the recent merger of the several companies in eastern New York was brought to a successful issue in the formation of the Mohawk & Hudson Power Corporation, of which he was elected president.

L. E. Dickinson Appointed Manager at Keokuk

L. E. Dickinson has been appointed manager of the Mississippi River Power Company, which was recently acquired by the North American Company from the Stone & Webster interests. Mr. Dickinson was born in Chicago and entered upon his career in the public utility field as a machinist in the locomotive shops of the Northwestern Railway. After four years in railway work he removed to the Northwest, affiliating himself with the Tacoma Power Company at Seattle, Wash., as substation operator. From this point his promotion was rapid, and during the following eleven years he served successively as superintendent of substations, superintendent of generating and substations and superintendent of operation, distribution and construction. In 1912, after spending a short period with the Electric Boat Company, Mr. Dickinson identified himself with the Mississippi River Power Company at Keokuk, then under the executive management of Stone & Webster. Since that date Mr. Dickinson has been a factor in the success of the Keokuk property, and the confidence of the new owners in his ability is shown by his appointment to the managership.

Four Vice-Presidents Named for Boston Edison Company

W. H. Atkins, general superintendent; Leavitt L. Edgar, assistant general superintendent; Thomas K. Cummins, treasurer, and Sidney Hosmer, superintendent of the construction bureau, were elected vice-presidents at the annual meeting of the Edison Electric Illuminating Company of Boston on March 16. They will retain their former titles, and such duties will be assigned to them as the president may specify in addition to their former activities.

Ross W. Cryder, who recently joined the General Engineering & Management Corporation, has been assigned to the Florida Power Corporation as general manager with headquarters at Dunnellon.

M. M. Nash has resigned as superintendent of the Terre Haute division of the Terre Haute, Indianapolis & Eastern Traction Company after 24 years of continuous service. **J. I. Beals** has been appointed to succeed Mr. Nash at Terre Haute. Mr. Beals was formerly general superintendent of the Monongahela-West Penn Public Service Company, Clarksburg, W. Va.

Martin E. Juhl, who was formerly manager of the Lake Superior District Power Company's electric properties at Washburn, Wis., has been selected to occupy the post of director of public relations for this company. The vacancy was created when C. D. Nason was promoted to be general manager Michigan Gas & Electric Company.

Raymond E. Haas, for many years New York representative of the United States Chamber of Commerce, has joined the staff of the General Engineering & Management Corporation as director of public relations. Mr. Haas has a wide acquaintance with public utility men and properties in the United States.

Harry J. Bauer, president of the Pacific Gasoline Company, has been elected a director of the Southern California Edison Company to fill the vacancy caused by the death of William E. Dunn. Mr. Bauer entered the employ of the company nineteen years ago as a junior clerk in the legal department two years before his graduation from the law school of the University of Southern California. During the succeeding years he rose through the gradations of the legal department

to the position of general counsel, retiring in 1919 to look after his own financial interests. Mr. Bauer's earliest business and legal training was under the guidance of the late Harry H. Trowbridge, general counsel of the Edison company, the able lawyer who in his association with President John B. Miller and Vice-president R. H. Ballard built up the legal business and financial structure of the parent organization which is now the Southern California Edison Company. For many years Mr. Bauer has been the close friend and associate of Mr. Miller, Mr. Ballard and all the officers and directors of the company, and he brings to the directorate an exact and intimate knowledge of its business, financial and legal affairs.

George H. Adler, formerly connected with the engineering department of the Public Service Company of Northern Illinois, has been transferred to the position of district engineer at Pontiac.

V. E. Todd, superintendent of the Fond du Lac plant of the Wisconsin Power & Light Company, has been transferred to Sheboygan in a similar capacity. **S. O. Biehl** has succeeded Mr. Todd at Fond du Lac.

W. F. Corl has resigned the presidency of the Community Power & Light Company, St. Louis, to become president of the Commonwealth Utilities Corporation with headquarters in St. Louis. The properties of the Commonwealth corporation are largely ice-manufacturing plants in Southern and Southwestern states.

Dr. C. A. Sawyer of Evanston, Wyo., has been elected a director of the Utah Power & Light Company to succeed General Bulkeley Wells of Telluride, Col., who is also president of the Western Colorado Power Company. Dr. Sawyer is a director of the Evanston National Bank and is also superintendent of the Wyoming State Mental Hospital at Evanston.

George W. Mason, general works manager of the Chrysler Corporation, has become identified with Copeland Products, Inc., as vice-president and general manager. Mr. Mason has had an unusually wide experience in the various branches of business and banking, including manufacturing, engineering, finance, purchasing and sales.

B. E. Waltz, formerly vice-president and general manager of the Michigan United Light & Power Company, Ludington, Mich., has been transferred to the Western United Gas & Electric Company at Aurora, Ill. Both these properties are under the management of the General Engineering & Management Corporation, the Western United having recently been acquired by the Fitkin interests. **W. A. Wadsworth** of Wichita, Kan., has been selected to succeed Mr. Waltz at Ludington.

George R. Mitten has recently been appointed industrial development engineer of the Public Service Company of Northern Illinois. Mr. Mitten was graduated from Purdue University and spent two years in the employ of the General Electric Company. Since 1919 he has served the Public Service Company in the capacity of power salesman. The industrial development department was established late in 1925 with the purpose of serving the industries already established in the territory and of bringing the advantages of the territory to the attention of organizations which might be desirous of relocating their plants or establishing new ones. The department is coordinating its work with that of the chambers of commerce, other civic organizations and also with the industrial bureaus of railroads, industrial real estate firms and other agencies.

E. O. Shreve Heads G. E. Industrial Department

E. O. Shreve, manager of the San Francisco office of the General Electric Company since 1918, has been named manager of the industrial department of the company, with headquarters at Schenectady, filling the vacancy caused by the recent death of A. R. Bush. Mr. Shreve was born in Mapleton, Iowa, Oct. 31, 1881. After his graduation from the Iowa State College in 1904

E. O. SHREVE

with a B.S. degree in engineering, he became a student engineer in the test department of the General Electric Company at Schenectady. In November of the following year he was transferred to what was then the supply department and in 1906 was sent to San Francisco as supply salesman. In 1909 he was made apparatus salesman in the lighting department and in July, 1917, was named assistant manager of the San Francisco office. He was promoted to be manager of the office in May, 1918, which position he held at the time of his recent promotion.

E. S. Noble, who for the past year has been manager of the Northern Canada Power Company, has been appointed assistant general manager of the Spruce Falls Pulp & Paper Company, Kapuskasing, Ontario.

W. W. Jacobs has been appointed manager of the East Tennessee district of the Tennessee Electric Power Company. Mr. Jacobs is a native Tennesseean and secured his first public utility experience with the Duck River Power Company. Subsequently he affiliated himself with the Public Light & Power Company, engaging in wiring new connections in various towns of middle Tennessee. Following his return to civilian life after military service he spent six months in the engineering department of the American Telephone & Telegraph Company and then entered the power sales department of the Chattanooga Railway & Light Company. Later he was transferred to Cleveland, Tenn., as retail manager of merchandise sales and new-business activities in the east Tennessee section, serving also as head of the security department for the district.

J. M. Strike, formerly research engineer of the Western division of the Doherty Operating Company, is now electrical superintendent of the St. Joseph (Mo.) Railway, Light, Heat & Power Company.

O. B. Connor, for many years connected with the Southern Wisconsin Electric Company as director of its public relations department, has left that company to join the staff of the Beloit Water, Gas & Electric Company.

G. B. Shawver, for five years manager of the Smith County (Tenn.) Electric Company, now the Carthage division of the Tennessee Electric Power Company, has been promoted to be superintendent of state plants.

C. N. Shuss, manager of the Central Kansas Public Service Company at Ellsworth, Kan., has been transferred to be general manager of the Great Bend (Kan.) Water & Electric Company and the Hoisington (Kan.) Electric & Ice Company. In this position Mr. Shuss succeeds P. B. Harbaugh, who has been transferred to Dalhart, Tex., as manager of the Dalhart Ice & Electric Company and the Dalhart Water Company.

Davis M. DeBard has been appointed sales engineer of Stone & Webster, Inc., Boston, and will be in general charge of load building in companies under this management, assisted by N. T. Wilcox. Mr. DeBard was for many years power sales engineer of the Edison Electric Illuminating Company of Brockton, Mass., and first president of the New England Central Station Association of Power Engineers. For several years he has been engaged in manufacturing work outside the electrical industry. His headquarters will be at 147 Milk Street, Boston.

Obituary

Edmund J. B. Huntoon, for many years identified with the securities department of Stone & Webster, Inc., Boston, died at Milton, Mass., March 8, at the age of 57. Mr. Huntoon was a native of Canton, Mass., and was educated at the Massachusetts Institute of Technology. He was active in the electric traction field for Stone & Webster prior to entering the securities division.

Willis T. Ryan, industrial engineer of the Washington Water Power Company, Spokane, Wash., died March 2 after a prolonged illness. Mr. Ryan entered the service of the Washington Water Power Company as draftsman. After two years in the engineering department he was appointed industrial engineer in charge of industrial power accounts in Spokane and vicinity under Lewis A. Lewis, sales manager.

Commission Rulings

Acquisition of Private Plant by a City.—Legal questions connected with the acquisition by the city of Chippewa Falls of the local plant of the Northern States Power Company were answered by the Wisconsin Railroad Commission as follows: (1) The statute governing the municipal acquisition of an electric system is followed in sufficient substance to present the question legally to the voters and to institute proceedings lawfully before the commission when the question is submitted to the voters as to whether the city shall purchase "the distribution system within the city," although it appears that the utility is operating both electric and gas plants, if there is no serious question that the voters were in fact aware that they were voting on the question of acquisition of the electrical distribution system. (2) A proceeding by a city to acquire an electric plant is not void because in submitting the question to the voters the method of payment was not specified and the statutory procedure outlined was not followed. (3) The commission should take jurisdiction over a proceeding by a city to acquire an electric plant regardless of the question as to how the city will raise funds for payment, unless it affirmatively appears that the voters were so misled as to the manner of raising the funds as to make the vote null and void.

Scrutiny of Contracts with Parent Companies Insisted Upon.—The Michigan Public Utilities Commission, although allowing payments by the Michigan Bell Telephone Company under the 4½ per cent contract to the American Telephone & Telegraph Company and a return on reinvested depreciation reserve, in view of a decision by the Supreme Court, said: "Although the Supreme Court held in effect that on the record before it this commission could not set aside the 4½ per cent contract, it likewise held that such contract might be scrutinized closely. If it is shown that such contract is not justified, we think the commission has the authority to modify the contract because subjecting the applicant to an unwarranted operating expense, and if that is done, the commission reserves the right to modify the contract in accordance with the facts shown. Although all of the operating expenses which the Supreme Court held should be allowed have been allowed because of its opinion, when and if the position of that court shall be modified, reservation is made of the right to compel the Michigan Bell Telephone Company to disgorge any money taken under the so-called 4½ per cent contract in excess of what it shall ultimately be determined it is entitled to receive, and the right is also reserved to recover such amounts as have been taken from the public by telephone rates to pay a return on reinvested depreciation reserve, used for the purpose of earning and paying dividends thereon to its stockholders."

Too Broad Powers Take Petitioning Company Out of Classification as Electrical Corporation.—In denying the petition of the New York-New Jersey Superpower Connecting Corporation, a New Jersey corporation, for authority to exercise franchises and begin construction of an electric distributing system to serve the towns of Cochecton, Lumberland, Tusten and Highland, in Sullivan County, N. Y., the New York Public Service Commission based its action on the belief that the petitioning corporation was not an electrical corporation under the meaning of the laws of New York and that therefore it could not exercise the privileges of such a corporation. The commission believed that under the provisions of its charter the corporation might engage in any mercantile business, carry on a stock-brokerage business or issue its bonds, debentures or other obligations for purposes wholly foreign to the purposes and wholly beyond the power and scope of business in which any electrical corporation of the State of New York may engage. The broad powers thus accorded the company would, the commission said, make it a business corporation rather than an electrical corporation, and as such it would have no power to exercise the rights of an electrical corporation in New York State.

Recent Court Decisions

Owner Held Liable Where Height of Dam Caused Flood, Despite Prescriptive Right Claimed.—In Goddard vs. Berlin Mills Company damages were awarded for loss from flood caused by the company's dam on the Androscoggin River. Sustaining the finding, the Supreme Court of New Hampshire said that the defendant could not escape liability for flowage on the ground that the damage, which came at a time of unusual floods, was "an act of God," since the maintenance of the dam increased the flowage and "acts of God" were such as arose without interference or aid from man. A dam owner could not set up prescriptive right to maintain a dam with 70 in. of flashboards by relying on evidence concerning an old dam for which the existing structure was substituted in 1898, where it was not shown conclusively that water was kept up in those times to the same extent as in later years or that there was ever any claim of right to do so. Nor could the defendant establish prescriptive right to maintain dam where plaintiff started his first suit within the twenty-year period, for by such action the plaintiff denied the defendant's right and negatived any idea of submission or acquiescence. (131 At. 601.)*

Notice of Filing of Rate Schedule Not Always Obligatory.—The city of Philadelphia resisted a suit brought by the Springfield Consolidated Water Company to recover under a schedule of rates filed pursuant to an order of the Public Service Commission, the city claiming among other things that it had had no proper notice of the new schedule, being omitted from the counties named. The Supreme Court of Pennsylvania held on this point that it is doubtful whether notice of the actual filing of a schedule of rates is necessary to a party engaged in the hearing. The court said: "The schedule evidences the commission's action and is binding not only on the parties but also on every person affected unless unusual circumstances are present. A defective notice printed on the back of the cover (if the omission can be considered a defect) will not invalidate the rate or suspend its operative effect. It might, under certain conditions as to those actually injured, have the effect of extending the time within which exceptions may be filed, but certainly not beyond a period when ordinary notice would be given, as, for example, the receipt of a bill under an increase." (131 At. 716.)

Additional Increase Refused to New York Telephone Company.—The United States Circuit Court in New York State has denied the petition of the New York Telephone Company for permission to add 35 per cent instead of the present tentative 10 per cent to New York City bills and to increase the up-state rate 18 per cent. Commenting adversely on the company's move, the court said: "We are asked to say that the rates which became effective on March 1, 1923, are void on the ground that they are confiscatory and to say it at a time when the Public Service Commission, which has been conducting an inquiry into the whole matter, is on the point of announcing its conclusion and fixing new rates. The concern of the courts in such cases is simply to prevent confiscation and the taking of private property for public use without just compensation. The courts can simply inquire whether the legislative power has fixed the rates so low as to deprive the public utility of its property in violation of the constitutional guarantees. It does not seem practicable at this time and until the special master heretofore appointed has made his report to undertake another and independent investigation or even to enlarge the scope of the inquiry which he is now conducting under the prior order of the court. And for the court to undertake to dispose of the question presented upon the unsatisfactory evidence of the *ex parte* affidavits made by witnesses who have not been subjected to cross-examination seems to us at this time particularly ill advised. We cannot in advance assume that the Public Service Commission, which has had this subject under investigation for months and is about to fix anew the rates to be charged, will establish confiscatory rates. To make any such assumption in advance of its action about to be taken would be to reflect upon that body in an unwarranted manner. . . . We shall assume that the Public Service Commission in fixing the new rates will fix them according to the principles laid down by the court in the former suit. If it disregards those principles, which we will not anticipate its doing, it will be time enough then to bring the matter to the court's attention."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Financial and Corporate

Utility Market Moderates

Price Movement Is Irregular—Trading Becomes Less Active—Changes in Value Small

FOLLOWING the demoralization of the stock market late in February and early March, trading, after the final crash of March 3, became less and less active until the market actually turned dull. Prices meanwhile in most groups tended to move within a narrower range, and in the week under review values fluctuated relatively little on the New York Stock Exchange. The great wave of liquidation released more money, and funds were offered at the lowest rates since early February. In the final week of the liquidation the total contraction of loans by sixty reporting member banks to brokers and dealers amounted to about $61,000,000, bringing the total volume of outstanding loans to the lowest volume recorded for the year to date.

While money eased perceptibly stock prices did not rally materially, however, and the market in public utility stocks was no exception to the general rule. The persistent unloading of stocks for what they would bring ceased, but after moderate recoveries all along the line the upward movement likewise ceased and since then values have about held on a dead level. A rally was made in United Light & Power A stock after its broad sinking spell, but weakness developed in the American States Securities issues.

On the big board American Water Works & Electric stock moved slightly upward and downward at different times, but on the week as a whole showed little change in position. A gain of four points was scored by the shares of the Puget Sound Power & Light Company, and slightly more than that was recorded in the week by the stock of the American Light & Traction Company. Ground was lost, on the other hand, by such issues as Tampa Electric, Electric Investors, Inc., and Northern States Power.

New Capital Issues

During the past week the Connecticut Light & Power Company issued 6½ per cent cumulative preferred stock to the amount of $5,500,000, the price being 102 and accrued dividends, to yield about 6.37 per cent. After retiring the floating indebtedness incurred on account of construction this offering will provide the company with more than $2,250,000 for present and future construction requirements.

Thirty-year 6 per cent sinking-fund collateral-trust gold bonds, series A, of the Municipal Service Company, totaling $5,500,000, were offered at 96 and accrued interest, to yield about 6.30 per cent. The proceeds from the sale of these bonds will be used in part to retire certain outstanding obligations and for capital additions. The company, incorporated in Maine, owns, controls or will acquire public utility companies in Pennsylvania, Maryland, Delaware, Virginia and Georgia.

A Japanese utility was represented in this week's offerings—the Imperial Electric Light Company, Ltd. The flotation consisted of a 7½ per cent bond issue, amounting to 20,000,000 yen. Early this year at a meeting of the stockholders of the company and of the Tokio Electric Light Company, Ltd., a resolution was passed authorizing the amalgamation of the two utilities.

The Carolina Power & Light Company made an offering on Wednesday of first and refunding mortgage gold bonds, amounting to $18,000,000 at 97¾ and accrued interest, to yield 5.15 per cent. The company is to be organized by merger and consolidation of the Carolina Power & Light Company, the Yadkin River Power Company, the Asheville Power & Light Company, the Pigeon River Power Company and the Carolina Power Company. The proceeds from the sale of these bonds will be used to retire certain indebtedness of these companies, for further capital expenditures and for other corporate purposes.

The Cities Service Company issued 250,000 shares of common stock at $42 a share. The stock has a par value of $20. The offering will not increase the amount of outstanding common stock, except as represented by conversions of outstanding convertible debentures.

Southern California Edison to Reclassify Stock.—At the annual meeting of stockholders of the Southern California Edison Company, March 19, a long-talked-of plan to reclassify all of its outstanding capital stock by issuing four shares of $25 par value for each share of $100 par value was unanimously approved. Approximately 1,041,118 shares (of par value $100) of all series outstanding in the hands of the public as of Feb. 28, 1926, will now be divided, making a total outstanding issue of 4,164,472 shares (par value $25). This change does not in any way affect the proportion of holdings, the rate of dividends or voting power of the present stockholders. Market value of the new stock will, of course, be approximately one-fourth of the market value of the old stock.

Stockholders Authorize Increase in Capitalization.—The addition of 75,000 shares of 7 per cent cumulative preferred stock of the par value of $100 a share to the present authorized capital stock of the Public Service Company of Northern Illinois was authorized by

Dividends Declared

The quarterly dividends listed below were recently announced

Name of Company	Per Cent	When Payable
Alabama Power, pf.	1¾	Apr. 1
Allis-Chalmers Mfg., pf.	1¾	Apr. 15
American & Foreign Power, pf.	$1.75	Apr. 1
American Gas & Electric, com.	.25	Apr. 1
American Gas & Electric, pf.	$1.50	May 1
American Power & Light, pf.	$1.50	Apr. 1
American Public Service, pf.	$1.75	Apr. 1
American Public Utilities, pr. pf.	$1.75	Apr. 1
American Public Utilities, ptc. pf.	$1.50	Apr. 1
Associated Gas & Elec., orig. pf.	.87½	Apr. 1
Assoc. Gas & Elec., orig. pf.(ex.)	12½	Apr. 1
Associated Gas & Elec., $7 pf.	$1.75	Apr. 1
Binghamton Light, Heat & Power, ptc., pf.	1¾	Apr. 1
Binghamton Light, Heat & Power, 6% pf.	1½	Apr. 1
Birmingham Electric, pf.	$1.75	Apr. 1
Central States Elec., com.	.25	Apr. 1
Central States Electric, pf.	1¾	Apr. 1
Century Electric	1½	Mar. 22
Columbus Elec. & Pwr., com.	2	Apr. 1
Columbus Elec. & Pwr., pf. B.	1¾	Apr. 1
Columbus Elec. & Pwr., 2d pf.	1¾	Apr. 1
Community Pwr. & Lt., com.	.25	Apr. 15
Duke Power	1	Apr. 1
Eastern Texas Elec., com.	$1.25	Apr. 1
Eastern Texas Elec., pf.	1¾	Apr. 1
Electric Bond & Share, pf.	1¼	May 1
Electric Bond & Share, Secur., cap.	.25	Apr. 15
Electric Controller & Mfg., com.	$1.25	Apr. 1
Electric Controller & Mfg., pf.	1¾	Apr. 1
Elec. Storage Battery, com. & pf.	$1.25	Apr. 1
Emerson Electric Mfg., pf.	1¾	Apr. 1
Florida Public Service, pf.	1¾	Apr. 1
Galveston-Houston Elec., pf.	3	Mar. 15
Illinois Power & Light, pf.	1¾	Apr. 1
Illinois Power & Light, 6% pf.	1½	Apr. 1
Kansas Electric Power, pf.	1¾	Apr. 1
Kansas Power & Light, 1st pf. A.	$1.75	Apr. 1
Long Island Ltg., pf.	1¾	Apr. 1
Manhattan Elec. Supply	$1.12½	Apr. 1
Metropolitan Edison, $7 pf.	$1.75	Apr. 1
Metropolitan Edison, $6 pf.	$1.50	Apr. 1
Middle West Utilities, com.	$1.50	May 15
Middle West Utilities, pf.	1¾	Apr. 15
Midland Utilities, pr. In.	1¾	Apr. 6
Midland Utilities, pf. class A	1¾	Apr. 6
Minnesota Power & Light, pf.	1¾	Apr. 1
Missouri Power & Light, 7% pf.	1¾	Apr. 1
Monon. West Penn P. S., 7% pf.	.43¾	Apr. 1
Mountain States Power, pf.	1¾	Apr. 20
Narragansett Elec. Ltg.	$1	Apr. 1
National Electric Power, pf.	1¾	Apr. 1
New England Public Serv., pr. In.	$1.75	Mar. 15
New Jersey Pwr. & Lt., ptc. pf.	1¾	Apr. 1
New York Central Elec., pf.	1¾	Apr. 1
North Amer. Light & Power, pf.	1¾	Apr. 1
North West Utilities, 7% pf.	$1.75	Apr. 1
Northern N. Y. Utilities, com.	.75	Mar. 30
Northern N. Y. Utilities, com. ex.	.25	Mar. 30
Northern States Pwr. com. A	2	May 1
Northern States Pwr., com. B	.20	May 1
Northern States Pwr., pf.	1¾	Apr. 20
Ohio Brass, class B	$1	Apr. 15
Ohio Brass, class B extra	$1	Apr. 15
Ohio Brass, pf.	1¾	Apr. 15
Penn Central Light & Power, pf.	$1.25	Apr. 1
Penn Power & Light, pf	$1.75	Apr. 1
Power Corporation of N. Y.	.25	Apr. 1
Springfield Ry. & Lt., pf.	1¾	Apr. 1
Standard Gas & Elec., com.	.75	Apr. 25
Standard Gas & Electric, 7% pf.	1¾	Apr. 25
Toledo Edison, pr. pf.	2	Apr. 1
United Gas Improvement	$1	Apr. 15
United Light & Power, pf. A.	$1.63	Apr. 1
United Light & Power, pf. B.	$1	Apr. 1
United Lt. & Pwr., old com A & B.	.60	May 1
United Lt.& Pwr., new com. A & B.	.12	May 1
United Lt.& Pwr.,new com.A & B*	....	May 1
United Lt.& Pwr.,old com. A & B†	....	May 1
Utah Power & Light, pf.	1¾	Apr. 1
Washington Water Power	2	Apr. 15
West Penn Electric, cl. A	$1.75	Mar. 30
Western Electric, com.	$2.50	Mar. 31
Western Power, 7% pf.	1¾	Apr. 15
Western States Gas & Elec., pf.	1¾	Apr. 15
Weston Elec. Instr., class A	.50	Apr. 1
Yadkin River Power, pf.	1¾	Apr. 1

* Payable in one-fortieth share new class A com.
† Payable in five-fortieths share new class A com.

the stockholders of the company at their annual meeting Feb. 23. Issuance of additional stock will probably not come until late in the year, however, it was announced by Samuel Insull, chairman. All directors of the company were re-elected at the meeting. The board of directors met immediately after the stockholders' meeting and re-elected all officers of the company.

Baltimore Consoldiated Issues Annual Report.—The operations of the Consolidated Gas, Electric Light & Power Company of Baltimore for the year ended Dec. 31, 1925, have been outlined in an unusually attractive and interesting report just released. Total gross operating revenue amounted to $22,746,143 as compared with $21,459,699 for the previous year. Revenue from electric sales contributed $14,191,571 to this total, against $12,995,375 to last year's total, an increase of 9.20 per cent. Net income showed a substantial increase—$1,355,203. During 1925 there was sold 645,215,639 kw.-hr. as compared with 582,904,527 kw.-hr. in 1924, and the number of customers of the company advanced from 142,527 to 158,608.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday March 13	Low 1926	High 1926
STOCKS			
ABITIBI PWR. & PAPER, com.—no par	79	71¼	84½
Adirondack Pwr. & Lt.—7% pf.	k104½	....	....
Adirondack Pwr. & Lt.—8% pf.	108	108	110
Adirondack Pwr. & Lt., com.—50	m 75	n 31	n 98
Ala. Pwr., pf.	k105½	....	....
Allis-Chalmers Mfg. pf.	k107½	107¼	110
Allis-Chalmers Mfg., com.	k 85	82½	94½
Aluminum Co. of Amer., com.	k 65	....	....
Aluminum Co. of Amer. new, pf.	k 98½	....	....
Amer. & Foreign Pwr., pf. 5% pd.	m125	127½	131
Amer. & Foreign Pwr., 7% pf.—no par	k 93	91½	98
Amer. & Foreign Pwr., com.—no par	k 25	22	42½
Amer. Bosch Magneto, com—no par	k 24½	20	34½
Amer. Brown Boveri Elec.	k 38½	35½	48½
Amer. Brown Boveri Elec. pf.	89½	89½	97½
Amer. Elec. pwr., pf.	c107	101½	108
Amer. Gas & Elec., 6% pf.—no par.	k 92½	92½	95½
Amer. Gas & Elec., com.—no par.	k 78	64	99½
Amer. Lt. & Trac., 6% pf.	k108	108	116½
Amer. Lt. & Trac., com.	m212	197	263
Amer. Pwr. & Lt., 6% pf.	k 92½	92½	94
Amer. Pwr. & Lt., com.—no par.	k 59½	50	79½
Amer. Pub. Serv., 7% pf.	k 96	....	....
Amer. Pub. Serv., com.	47	45	80
Amer. Pub. Utilities, 4% pf.	k 87	....	....
Amer. Pub. Utilities, 6% pf.	87	85	86
Amer. Pub. Utilities, 7% pf.	k 90	....	....
Amer. Pub. Utilities, com.	78	80	82
Amer. States Sec., A	m 8	....	....
Amer. States Sec., B	k 1	....	....
Amer. Superpwr., pf.—25	k 25	24½	26½
Amer. Superpower, pf.	91	93	94
Amer. Superpwr., Class A—no par.	k 25½	22	37½
Amer. Superpwr., Class B—no par.	k 26½	22½	39
Amer. Wtr. Wks. & Elec., 7% pf.	103	101½	108½
Amer. Wtr. Wks. & Elec., com.—20.	k 54	48	74
Anaconda Copper	k 46½	42	51
Appalachian Pwr., 7% pf.	100	99	101
Appalachian Pwr., 1st pf., 7%	102	99	101
Appalachian Pwr., com.	80	80	83
Arizona Pwr., 7% pf.	k 78	....	....
Arizona Pwr., com.	m 27	27	35½
Arkansas Cent. Pwr., pf., $7—no par	103	99	102
Arkansas Lt. & Pwr., 7% pf.	k 98	....	....
Arkansas Lt. & Pwr., com.	98	100	102
Asheville Pwr. & Lt., 7% pf.	i104	100½	104
Assoc. G.&E., 7% pf.—1% ext'a—50	k 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	k 78	....	....
Assoc. Gas & Elec., Class A—no par	k 29½	25½	35½
BABCOCK & WILCOX, com.	k140	....	....
Binghamton Lt., Ht. & Pwr., pf.	105	....	....
Birmingham Elec. pf.—$7—no par.	103	102	103½
Blackstone Valley Gas & Elec., pf.	100	102	106
Blackstone Valley G.&E., com.—50.	k 95½	95½	118½
Blaw-Knox, com.	f 47½	45	56
Brazilian Trac., Lt. & Pwr., com.	f 93½	....	....
Broad River Pwr., pf.	k 95	....	....
Brooklyn Edison, com.	k139	133½	146½
Buffalo Gen. Elec., com.—no par.	m 58	n 50	n 77
Buffalo, Niagara & East. Pwr., pf.—25	k 24½	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par	k 28½	....	....
CALIFORNIA ELEC. GENERATING, pf.	92	89	93
California Ry. & Pwr., pf.	87	88	92
Carolina Pwr. & Lt., pf.—$7—no par	104	105	107
Carolina Pwr. & Lt., com.	m420	n290	n456½
Cent. & S. W. Ut. 7% pf.—no par	a 92½	89½	94
Cent. & S. W. Ut., pr. ln. pf.—no par	a 98	95½	100
Central Ariz. Lt. & Pwr., pf.	102	....	....
Central Ark. Ry. & Lt., 7% pf.	k 99	....	....
Central Ill. Pub. Serv., 6% pf.	89	89	91
Central Ind. Pwr., 7% pf.	97½	89	98½
Central Pwr. & Lt., pf.	97½	95½	98½
Central States Elec., 7% pf.	k 93	....	....
Central States Elec., com.	m200	200	230
Century Elec., com.	m103	n103	n110
Chicago Fuse Mfg., com., no par.	a 33½	31½	35
Cincinnati Gas & Elec., com.	g 94	89	95
Cities Service, 6% pf.	k 83½	....	....
Cities Service, pf. B—10.	k 7½	....	....
Cities Service, pf. BB—100.	k 75	....	....
Cities Service, com.—20.	k 41½	....	....
Cities Service, Bks. Shrs.—10.	k 19½	....	....
Clarion River Pwr., pf.	93	93	95
Cleveland Elec. Illg., 6% pf.	103	104	105½
Cleveland Elec. Illg., com.	k200	....	....
Colorado Pwr., 7% pf.	k 96	....	....
Columbia Gas & Elec., 7% pf.	114½	113	115
Columbia Gas & E., com.—no par.	k 80	75½	90
Columbia Ry., Gas & Elec., 6% pf.	k114½	95	96
Columbus Elec. & Pwr., 2d pf.	k101	....	....
Columbus Elec. & Pwr., com.	k180	....	....
Columbus Ry., Pwr. & Lt., 1st. pf.	97½	98	99
Columbus Ry., Pwr. & Lt., pf. B.	93	92	95
Col. Ry., Pwr. & Lt., com.—no par.	82	82	85
Commonwealth Edison, com.	a141½	139½	144
Commonwealth Pwr., 6% pf.	k 84½	....	....
Commonwealth Pwr. com.—no par.	k 33½	28½	42½
Conn. Lt. & Pwr., 8% pf.	118	118	121
Conn. Lt. & Pwr., 7% pf.	110	110	113
Cons. Gas of N. Y., pf.—50.	k 58½	....	....
Cons. Gas of N.Y., com.—no par.	k 94½	90½	104½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	e 105	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti 6½% pf.	e110	108½	110
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	e115	110½	115½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	e128	124	128½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par	e 50	45	57½
Cons. Utilities of Dela., 7% pf.	m 85	n 80	n 84
Consumers Pwr., 6% pf.	97½	95	98
Consumers Pwr., 6.6% pf.	103	101½	103½
Continental Gas & Elec., 7% pfc. pf	k 98	....	....
Continental Gas & Elec., 7% pr. pf.	k 96	....	....
Continental G.&E., com.—no par.	m125	130	150
Crocker Wheeler, com.	18	14	19
Crocker Wheeler, pf.	50	50	55
DALLAS PWR. & LT., 7% pf.	104	102	104
Dayton Pwr. & Lt., 6% pf.	97½	95	97
Dayton Pwr. & Lt., com.	m420	n180	n460
Detroit Edison, com.	k128	124½	141½
Dubilier Condenser & Radio, com. no par	k 7	6	11
Duquesne Elec., 6% pf.	95	93	97
Duquesne Lt., 7% pf.	k112½	111½	114
EAST, N. Y. UTIL. pf.	85	....	....
Eastern New York Util., com.	75	....	....
Eastern States Power.	k 23	....	....
Eastern States Pwr., pf. with warrants	m120	....	....
Eastern States Pwr., pf. without warrants	k 90	....	....
Eastern Tex. Elec., 7% pf.	k102	....	....
East. Tex. Elec., com.—no par.	105	103	107
Edison Elec. Illum. of Boston, com.	d226	207	250
E. Paso Elec., com.—no par	k 85	....	....
E. Paso Elec. pf.	97	97	98½
Elec. Bond & Share, 6% pf.	k105½	103½	107½
E. Bd. & Share Sec., com.—no par.	i 66	64½	86
Elec. Investors, 6% pf.—no par.	91	92	95
Elec. Investors, com.—no par.	k 46½	41½	74½
Elec. Investors, 10% pd. receipts.	30	....	....
Elec. Pwr. & Lt., ctfs., pf.	k 93	90½	97½
Elec. Pwr. & Lt., ctfs., 40% pd.	k102½	102	115
Elec. Pwr. & Lt., ctfs. full pd.	107	100½	110½
Elec. Pwr. & Lt. ctfs. com.—no par	k 22½	18	34½
Elec. Ry. Securities, com.—no par.	m 5	....	....
Elec. Refrig.	k 67	59½	90½
Elec. Storage Battery, com.—no par.	k 79½	71½	79½
Elmira Wtr., Lt. & R. R., 7% pf.	97	97½	99½
Emerson Elec. pf.	m102½	100	104½
Empire Dist. Elec., 6% pf.	80	80	85
Empire Pwr., A	k 28½	27½	32
Eng. Pub. Serv., pf.—no par.	k100½	98½	104
Engr. Pub. Serv., com.—no par.	k 26	24	29½
Eureka Vac. Cleaner, com.—no par.	k 47½	47	53½
FAIRBANKS MORSE, com—no par	52½	49	59½
Fairbanks Morse, pf.	k111½	108½	115
Federal Lt. & Trac., com.	k 33½	28½	39½
Federal Light & Traction, pf.	k 86½	87	89
Federal Utilities, pf.	k 75	....	....
Federal Utilities, com.	k 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	i106	105	107
GALVESTON-HOUSTON ELEC., 6% pf.	k 57	....	....
Galveston-Hstn El., com.	k 22	....	....
Gen. Elec., com.	k327	302	386½
Gen. Elec., special—10.	k 11½	11	11½
Gen. Gas & Elec., A	k 47½	44½	59
Gen. Gas & Elec., pf. A.	m 98½	98½	99½
Gen. G.&E., (Del.) com. A no par.	m49½	47½	55
Gen. G.&E., (Del.) com. B no par.	m35	35	47
Gen. G.&E., (Del.) A pf. $8—no par	108½	108½	110½
Gen. G.&E., (Del.) A pf. $7—no par	97½	97½	99½
Gen. G.&E., (Del.) B pf.	94½	95½	96½
General Public Service, pf.	k102	101½	106½
General Public Service, com.	15	13½	16½
Ga. Lt., Pwr & Rys., 6% pf.	80	82	85
Ga. Lt., Pwr. & Rys., com.	m 58½	58	75
Ga. Ry. & Elec., 5% pf.	m 70	n 78½	n 84½
Ga. Ry. & Elec., com.	m126	n115½	n115½
Ga. Ry. & Pwr., 8% pf.	112	112	114
Ga. Ry. & Pwr., 7% pf.	101	101½	103
Ga. Ry. & Pwr., 4% pf.	m133	....	....
Ga. Ry. & Pwr., com.	m133	....	....
Gt. Western Pwr., 7% pf.	k100	....	....
HAVANA ELEC. UTIL., com.	k 43½	43	44½
Havana Elec. Util., pf.	k 70½	67	71½
Hurley Machine, com.—no par.	m 50½	44½	51
IDAHO PWR., 7% pf.	103	103	104
Ill. No. Utilities, 6% pf.	90	88	92
Ill. Pwr. & Lt., 7% pf.	k 96½	....	....
Ingersoll Rand	k 91	87	105
Int. Combus. Engr., com.—no par.	k 47½	40	64½
Int. Utilities, class A—no par.	k 34½	....	....
Int. Utilities, class B—no par.	k 5½	5	9½
Interstate Pwr., pf., $7 no par.	k 93½	....	....
Interstate Pub. Serv., 7% pf.	96½	96½	97
Iowa Ry. & Lt., 7% pf.	95	98	100
JERSEY CENTRAL PWR. & LT. 7% pf.	95	95½	96½
Jersey Central Pwr. & Lt., com.—no par	45	45	50
Johns-Manville, com.—no par.	143½	136	159½
KANSAS CITY PWR. & LT., pf.	109½	107½	110½
Kansas Gas & Elec., 7% pf.	i101	99½	102
Kelvinator Corp., com.—no par.	m 76	76	89½
Kentucky Hydro-Elec., pf.	m 95	92	95
Kentucky Sec., 6% pf.	79	75	77
Kentucky Sec., com.	k 90	....	....
Kentucky Utilities, 6% pf.	90	90	95
Keystone Pwr. & Lt. 7% pf.	95	95	97
Kings County Ltg., 7% pf.	103	103	106
Kings County, Ltg., 8% pf.	105	105	108
LACLEDE GAS LT., com.	153	152	168
Lehigh Pwr. Sec., com.—no par.	k 14½	10	23
Long Island Ltg., 7% pf.	106½	105	107
Long Island Ltg., com.—no par.	125	145	150
Los Angeles Gas & Elec., 6% pf.	95	95½	97
Louisville Gas & Elec., Class. A.	k24½	22½	26½
MANHATTAN ELEC. SUPPLY.	k 69½	56	76½
Manila Elec., com.—no par.	29½	29½	35
Maytag Mfg., com.	k 22½	19	23½
Memphis Pwr. & Lt., pf., $7, no par	104	103	105
Metro. Edison, pf.—$6—no par.	k 93	....	....
Metropolitan Edison, pf., $7, no par.	k102½	....	....
Metropolitan Edison, com., no par.	45	45	50
Middle West Utilities, 7% pf.	a108	97½	111½
Middle West Utilities, 7% pr. lien pf.	a118	108½	123½
Middle West Utilities, com.—no par.	a119	109	134½
Midland Utilities, pr. ln. pf.	a 99½	99	100
Midland Utilities pf. A	a 97	96	98
Milwaukee Elec. Ry. & Lt., 7% pf.	98	100	102
Milwaukee Elec. Ry. & Lt., 6% pf.	91	87	88½
Minn. Pwr. & Lt., 7% pf.	i102	100½	103½
Miss. Pwr. & Lt., pf.	k102	....	....
Miss. River Pwr., 6% pf.	94	94	96
Miss. River Pwr., com.	k 60	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.	103	101	105
Mohawk Hudson Pwr., 2nd pf.—$7—no par	95	90	97
Mohawk Hudson Pwr., com.—no par	k 24	21½	28½
Montana Pwr., pf.	m 115½	112½	119½
Montana Pwr., com.	k 72½	71	83½
Montreal Pwr., com.	f 220	....	....
Mountain States Pwr., pf.	k 95	....	....
Mountain States Pwr., com.	k 24	....	....
NASSAU & SUFFOLK. LTG., pf.	93	93	95
National Carbon, com.	m124	n120	n130
National Carbon, pf.	a126	125	127½
National Elec. Pwr., pf.	a 95	93	96½
National Electric Pwr-A	a 21½	20	28
Nat.-Lt., Ht. & Pwr., com.—no par.	24	22	25
National Lt., Ht. & Pwr., 5% pf.	72	71	73
National Pwr. & Lt., pf., $7—no par.	k 99½	98	102½
National Pwr. & Lt., com.—no par.	k 22½	16½	38½
National Pub. Serv., 7% pf.	91	90	94
National Pub. Serv., pfc. pf.	96½	96	97½
National Pub. Serv., A com.—no par	k 19½	15½	24
National Pub. Serv., B com.—no par	k 12½	10	17½
Nebraska Pwr., 7% pf.	i 104	103	105½
Nevada-Calif. Elec., com.	24½	18½	44½
New Brunswick Pwr., pf.	35	30	40
New England Pub. Serv., pr. ln. pf.	96	98	99½
New England Pub. Serv., pf.	90	95½	97
N. J. Pwr. & Lt., 7% pf.	103	104	108
New Orleans Pub. Serv., 7% pf.	101½	100	102
New Orleans Pub. Serv., com.—no par.	m 30	n 31	n 38½
N. Y. Central Elec., 7% pf.	98½	98	100
Newport News & Hampton Ry., Gas & Elec., com.	108	108	112
Newport News & Hampton Ry., Gas & Elec., pf.	108	109	114
Niagara Falls Pwr., 7% pf.—25.	k 28½	27½	28½
Niagara, Lock. & Ont. Pwr., 7% pf.	110	110	111½
Niagara, Lock. & Ont. Pwr., com.—no par.	m 60½	n 60	n 73
Niser Corp., A.—no par.	m 84½	n 37	n 84½
Niser Corp., B.—no par.	m 69	60	89½
No. Amer., 6% pf.—50.	49½	49	50½
No. Amer., com.—10.	k 54½	47½	67
No. Amer. Edison pf.—no par.	k 93	92½	95½
No. Amer., Lt. & Pwr., pf.	92	88	90
N.C. Pub. Serv., pf.—$7—no par.	k 90	....	....
Northeastern Pwr., com.	k 24½	20½	36½
No. Indiana Gas & Elec., pf. A.	99	98	100
No. N. Y. Utilities, 7% pf.	k102½	....	....
No. Ohio Pwr., com.—no par.	k 17½	15½	26½
No. Ohio Trac. & Lt., 6% pf.	78	78	81
No. Ohio Trac. & Lt., 7% pf.	88	88	91
No. Ont. Lt. & Pwr., pf.	k 75	....	....
No. Ont. Lt. & Pwr., com.	48	45	68
No. States Pwr., 7% pf.	k101	100	101½
No. States Pwr. com.	113½	101½	136½
No. Texas Elec., 6% pf.	m 58	60	65
No. Texas Elec., com.	m 40	40	45
OHIO BRASS, com. B—no par.	70	70	79
Ohio Brass, pf.	98	98	101
Ohio Gas & Elec., 7% pf.	90	92	95
Ohio Pwr., 6% pf.	93	93	95
Ohio Pub. Serv., 6% pf.	90	90	93
Ohio Pub. Serv., 7% pf.	99½	98½	100
Ohio River Edison, pf.	99½	100	101
Oklahoma Gas & Elec., pf.	k 95	....	....
PACIFIC GAS & ELEC., 6% pf.	k 98½	....	....
Pacific Gas & Elec. com.	k125½	122	132½
Pacific Pwr. & Lt., 7% pf.	i100½	98	101½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high. lBid, low, high, Wednesday, March 17. mLatest quotations available. n1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday March 13	Low 1926	High 1926
STOCKS—Continued			
Parr Shoals Pwr., 6% pf.	92	....	....
Penn Central Lt. & Pwr., pf.—no par	c 73½	72½	73½
Penn-Ohio Elec., 7% pf.	95½	95½	98
Penn-Ohio Pwr. & Lt., 7% pf.	96	94	97
Penn-Ohio Pwr. & Lt., 8% pf.	104	100	106
Penn Pwr. & Lt.—$7—no par	/105½	103	106½
Penn Pub. Serv., 7% pf.	98	96	100
Penn Pub. Serv., 6% pf.	85	85	90
Penn Wtr. & Pwr., com.	c150	150	171
Phila. Co., 5% pf.—50	m38	37½	38
Phila. Co., 6% pf.—50	k 50½	47½	50
Phila. Co., com.—50	k 63½	59½	70½
Phila. Elec., com.—25	c 52½	43½	67½
Pittsburgh Utilities, pf.—10	k 15½	14½	16½
Portland Elec. Pwr., 7% pf.	97½	97	98
Portland Elec. Pwr., 6% pf.	72	71	75½
Portland Elec. Pwr., com.	k 43	....	....
Portland Ry., Lt. & Pwr.,pf.	m 72½	....	....
Portland Ry., Lt. & Pwr., com.	m 49	....	....
Potomac Elec. Pwr., pf.	/107½	....	....
Pwr. Corp. of N. Y., 7% pf.	m110	n 96	n112
Pwr. Corp. of N.Y., com—no par	m 79	77½	90½
Pwr. Sec., pf.—no par	k 21	....	....
Pwr. Sec., com.—no par	k 10	....	....
Pub. Serv. of N. J., 7% pf.	107½	103½	110
Pub. Serv. of N. J., 8% pf.	k117	115	119
Pub. Serv. of N. J., com.—no par	k 79½	72	92½
Pub. Serv. of No. Ill., 6% pf.	a102	100½	102½
Public Serv. of No. Ill., 7% pf.	a116	112	116½
Pub. Serv. of No. Ill., com.—no par	m134	130	137
Pub. Serv. of No. Ill., com.	a132½	130	135
Pub. Serv. of Okla., 7% pf.	93	92	95
Pub. Serv. Elec. & Gas, 6% pf.	98½	97	99½
Puget Sound Pwr. & Lt., 7% pf.	k107	....	....
Puget Sound Pwr. & Lt., 6% pf.	k 84	....	....
Puget Sound Pwr. & Lt., com.	k 52	....	....
Radio Corp. of Am., pf.—50	46½	44½	47½
Radio Corp. of Amer., com.—no par	k 37½	32½	46½
Republic Ry. & Lt., pf.	k104	....	....
Republic Ry. & Lt., com.	85	88	97
Rochester Gas & Elec., 5% pf.	95	80	98
Rochester Gas & Elec., 6% pf.	101	100	102
Rochester Gas & Elec., 7% pf.	104	105	107
St. Joseph Ry., Lt., Ht. & Pwr., pf.	65	60	65
Servel Corp., Class A	k 25	20½	30½
Servel Corp., Class B—no par	k 45	....	....
Sierra Pacific Elec., com.	k 27	23	28½
Sioux City Gas & Elec., 7% pf.	97½	96	98
S. E. Pwr. & Lt., pf.—$7—no par	97	97	100
S. E. Pwr. & Lt., com.—no par	k 30½	24	46½
So. Calif. Edison, 8% pf.	135	135	140
So. Calif. Edison, 7% pf.	k110	....	....
So. Calif. Edison, 6% pf.	k 97½	....	....
So. Calif. Edison, com.	k124	115½	142
Southern Cities Utilities, 7% pf.	86	86	89
Southern Cities Utilities, com.	k 31	....	....
Southern Pwr. & Lt. of Md., pf.	m107	....	....
Southern Pwr. & Lt. of Md., com.	m 32	....	....
Southwestern Lt. & Pwr., A	k 55	....	....
Southwestern Lt. & Pwr., B	k 45	....	....
Southwestern Lt. & Pwr., $6 pf.	k 80	....	....
Southwestern Pwr. & Lt., 7% pf.	k101	....	....
Springfield (Mo.) Ry. & Lt., 7% pf.	96	....	....
Standard Gas & Elec., 8% pf.	m156	54½	57½
Standard Gas & Elec., 7% pf.	k101½	....	....
Standard Gas & Elec., com.—no par	k 56½	51	69
Standard Pwr. & Lt., 7% pf.	k 91½	....	....
Superheater, com.—no par	k136	....	....
Syracuse Lighting, 7% pf.	105	105	107
Syracuse Lighting, 8% pf.	118	....	....
Syracuse Lighting, com.	250	260	275
Tampa Elec., com.	k301	292	330
Tenn. Elec. Pwr., 6% pf.	k 88	....	....
Tenn. Elec. Pwr., 7% pf.	k101	....	....
Tenn. Elec. Pwr., pf.—$6—no par	m 80	....	....
Tenn. Elec. Pwr., com.—no par	m 65	....	....
Terre Haute, Ind. & East Trac., pf.	20	23	37
Terre Haute, Ind. & East. Trac., com	3	3	5
Tex. Pwr. & Lt., 7% pf.	/104	102	105
Tide Water Pwr., 8% pf.	k 98	....	....
Timken Roller Bearing, com—no par	k 52½	44½	56½
Toledo Edison, 8% pf.	112	112	114
Toledo Edison, 7% pf.	k101½	....	....
Toledo Edison, com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	88½	87½	89
United Gas & Elec., 6% pf.	95	94	97
United Gas & Elec., com.—no par	m57	56	66
United Gas & Elec. (N.J.), 5% pf.	70	70	75
United Gas Impr.—50	c102½	91	144½
United Lt. & Pwr., pf.—$4—no par	k 49½	....	....
United L. & P. pf.—$6.50—no par	86	88	91
United Lt. & Pwr., com., A—no par	k 82½	70½	143½
United Lt. & Pwr., com., B—no par	86	140	165
Utah Pwr. & Lt., 7% pf., ex. div.	/100½	99	103½
Utica Gas & Elec., 7% pf.	105	103	105
Utica Gas & Elec., com.	200	....	....
Utilities Pwr., & Lt., 7% pf.	k 93	....	....
Utilities Pwr. & Lt., com. B—no par.	17	15	18
Vermont Hydro - Elec., 7% pf.	95	95	96
Virginian Pwr., 7% pf.	105	102	104
Virginan Pwr., com.	65	....	....
Virginia Ry. & Pwr., com.	k150	150	150
Wagner Elec., pf.	b 80	80	85
Wagner Elec., com.—no par	b 25½	25	34½
Washington Ry. & Elec., com.	/205	....	....
Washington Ry. & Elec., pf.	f 90½	....	....
Washington Wtr. Pwr., com.	130	130	134
West Mo. Pwr., 7% pf.	k 91	....	....
West Penn., 7% pf. temp. ctfs.	99	95½	101
West Penn, com.	125	118	130
West Penn Elec., pf.	97	96½	100½
West Penn Elec., Class A	93	88½	97
West Penn Pwr., pf.	k110½	108½	112
West Va. Lt., Ht. & Pwr., 7% pf.	95	95	98
West Va. Utilities, 7% pf.—50	42	43	45
Western Pwr., 7% pf.	k 96	....	....
Western Pwr., com.—no par	m 80	n 34	n102
Western States Gas & Elec., 7% pf.	k 91	....	....
Western States Gas & Elec., com	k 18	....	....
Westinghouse El. & Mfg., com—50	k 72	66	79½
Weston Elec. Instrument, Class. A	k 28½	27½	31½
Weston Elec. Instrument, com.	17½	15½	19
Wheeling Elec., pf.	91	91	93½
Wis.-Minn. Lt. & Pwr., 7% pf.	m 90	....	....
Wis. Pwr., Lt. & Ht., 7% pf.	85	85	90
Worthington Pump, pf. A	74½	75½	80
Worthington Pump, pf. B	55	60	65
Worthington Pump. com.	k 29½	26½	44½
Yadkin River Pwr., 7% pf.	/104½	102	105
Yale & Towne, com.—25	62	60½	64½

BONDS

Abitibi Pwr., & Paper	6s	1940	k101½	....	....
Adir. Elec. Pwr.	5s	1962	k100½	....	....
Adir. Pwr. & Lt.	6s	1950	k105½	....	....
Adir. Pwr. & Lt.	5s	1930	96	97	99
Ala. Pwr.	5s	1946	99½	99	100½
Ala. Pwr.	5s	1951	97½	97	99½
Ala. Pwr.	6s	1951	104½	104½	105½
Ala. Trac., Lt. & Pwr.	5s	1962	111	112	124
Aluminum Co. of Amer.	7s	1933	k107	106½	107½
Amer. Bosch Magneto	8s	1936	m103	2	....
Amer. Gas & Elec.	5s	2007	92	92	93½
Amer. Gas & Elec.	6s	2014	k 99½	98	100
Amer. Pwr. & Lt.	6s	2016	k 97½	96	98
Amer. Pub. Serv.	6s	194?	99½	98½	100½
Amer. Wtr. Wks. & Elec.	5s	1934	k 96½	....	....
Amer. Wtr. Wks. & Elec.	6s	1975	k 94	93	94½
Anaconda Copper	6s	1929	k102½	102½	103½
Anaconda Copper	6s	1953	k103½	....	....
Anaconda Copper	7s	1938	k105½	....	....
Appalachian Pwr.	5s	1941	k 99½	....	....
Appalachian Pwr.	6s	2024	94	93½	95
Appalachian Pwr.	7s	1936	105½	105	106½
Arizona Pwr.	6s	1933	100	99½	101
Arizona Pwr.	6s	1947	96	95½	97
Ark. Central Pwr.	6s	1948	102½	102	103½
Ark. Lt. & Pwr.	6s	1945	k104½	....	....
Ark. Lt. & Pwr.	6s	1954	k100½	....	....
Assoc. Gas & Elec.	6s	1965	k 93	92½	94½
Assoc. Gas & Elec.	6½s	1954	k100½	....	....
Berlin City Elec.	6½s	1928	k 98½	98½	99½
Berlin City Elec.	6½s	1929	k 97½	97½	98½
Binghamtpn Lt., Ht. & Pwr.	5s	1946	k 99	....	....
Birmingham Elec.	6s	1954	103½	102½	104
Birmingham Ry., L. & P.	4½s	1954	90½	88	91½
Broad River Pwr.	6½s	1934	100	100	102
Brooklyn Edison	5s	1949	k103½	....	....
Brooklyn Edison	6s	1930	105	103½	106½
Buffalo Gen. Elec. 1st	5s	1939	102	101½	102½
Buffalo G. E., 1st & Ref.	5s	1939	102	101½	102½
Buffalo G. E.	5s	1956	101	99½	101½
Burlington Ry. & Lt.	5s	1932	97	96	97½
Butte Elec. & Pwr.	5s	1951	k100½	....	....
Calif. Elec. Gen.	5s	1948	k100½	....	....
Calif. Gas & Elec.	5s	1937	100½	100½	101½
Calumet Gas & Elec.	5½s	1960	98	97½	99
Canadian Lt. & Pwr.	5s	1949	62	56	64
Canton Elec.	5s	1937	100½	100	101
Carolina Pwr. & Lt.	5s	1938	101	100½	101½
Carolina Pwr. & Lt.	6s	1953	104½	104½	105½
Cedar Rap. Mfg. & Pwr.	5s	1953	100	99½	100½
Central Ark. Ry. & Lt.	5s	1928	99½	99	100½
Central Ga. Pwr.	5s	1938	95½	95	96½
Central Ill. Lt.	5s	1943	k 98½	....	....
Central Ill. Pub. Serv.	5s	1952	92½	92	93½
Central Ill. Pub. Serv.	5½s	1950	96	96	97½
Central Ill. Pub. Serv.	6s	1944	99½	99	101½
Central Ind. Pwr.	6s	1947	98½	98	99½
Central Ia. Pwr. & Lt.	6s	1944	100	99½	101
Central Maine Power	5s	1939	98½	98½	100
Central N. Y. Gas & El.	5s	1941	k 98	....	....
Central Pwr. & Lt.	6s	1946	k101½	....	....
Central Pwr. & Lt.	6½s	1952	k104	....	....
Central States Elec.	6s	1945	96½	96	98½
Chattanooga Ry. & Lt.	5s	1956	84	81	85
Cincinnati Gas & Elec.	5s	1956	k102	....	....
Cincinnati Gas & Elec.	5½s	1961	104	102½	104½
Cities Service	6s	1966	k 93½	93½	94
Cities Service	7sB	1966	k187	....	....
Cities Service	7sC	1966	k130½	....	....
Cities Service	7sD	1966	k103½	101½	103½
Cities Service	7sE	1966	k109½	....	....
Cities Service Pwr. & Lt.	6s	1944	k 95½	93½	95
City L. & T., Sedalia, Mo	5s	1952	84	83	85½
Cleveland Elec. Illum.	5s	1939	102½	102½	103½
Cleveland Elec. Illum.	5s	1954	k103½	....	....
Cleveland Elec. Illum.	7s	1941	111	110	112
Colorado Pwr.	5s	1953	96½	95½	97½
Columbia Gas & Elec.	5s	1927	100	100	101½
Columbia Ry., Gas & El.	5s	1936	92½	92½	95
Columbus, Dela. & Marion Elec.	5s	1937	84	83½	86
Columbus, Dela. & Marion Elec.	6s	1937	94	93½	96
Columbus Elec. & Pwr.	6s	1947	k102	....	....
Columbus Ry., Pwr. & Lt.	5s	1940	k 98	....	....
Columbus Ry., Pwr. & Lt.	6s	1941	k103	....	....
Commonwealth Edison	5s	1943	k102½	....	....
Commonwealth Edison	5s	1953	100	99½	101
Commonwealth Edison	5s	1954	k100	....	....
Commonwealth Pwr.	5s	1939	k 91½	....	....
Commonwealth Pwr.	6s	1972	k 96	....	....
Commonwealth Pwr.	6s	1947	k103½	....	....
Community Pwr. & Lt.	6s	1950	99	98	99½
Conn. Ry. & Ltg.	4½s	1951	90½	91½	92
Consol. Cities Lt., Pwr. & Trac.	5s	1962	80½	80	82½
Consol. Elec.	5s	1955	97½	98	99
Consol. Gas of N. Y.	5½s	1945	k105½	....	....
Con. Gas, Elec. Lt. & Pwr. of Balti.	4½s	1935	97½	97½	98½
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	6s	1949	c106½	105½	107
Con. Gas, Elec. Lt. & Pwr. of Balti.	5s	1965	m100½	100	101
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	5½s	1952	c105½	104½	105½
Con Gas, Elec. Lt. & Pwr. (notes)	6½s	1951	m109½	109½	109½
Consumers Elec. L. & P.	5s	1936	k 97	....	....
Consumers Pwr.	5s	1936	k 97	....	....
Consumers Pwr.	5s	1952	k101½	97½	101½
Consumers Pwr.	5½s	1954	k103½	....	....
Continental Gas & Elec.	5s	1927	k100	....	....
Continental Gas & Elec.	6s	1947	k101½	....	....
Continental Gas & Elec.	6½s	1964	k 99	....	....
Continental Gas & Elec.	7s	1954	k107	....	....
Cumberland Cty. Pw.& Lt.	5s	1942	95	94	96½
Dallas Pwr. & Lt.	6s	1949	104	104	105
Dayton Ltg.	5s	1937	100	100	101
Dayton Pwr. & Lt.	5s	1941	k 101	....	....
Defiance Gas & Elec.	5s	1942	98½	98	99
Denver Gas & Elec.	5s	1949	98½	98	100
Denver Gas & Elec. Lt.	5s	1951	k 95½	....	....
Des Moines Elec.	5s	1938	100	99	100½
Detroit Edison	5s	1933	101½	101	102½
Detroit Edison	5s	1940	k102½	....	....
Detroit Edison	5s	1949	100½	100	102½
Detroit Edison	5s	1955	100½	100½	101½
Detroit Edison	6s	1932	m135	135	135
Detroit Edison	6s	1940	108½	107½	108½
Detroit Edison	7s	1928	m134	....	....
Detroit Edison	7s	1929	m130	130	130
Detroit Edison	7s	1930	125½	125½	138½
Dominion Pwr. & Trans	5s	1932	96½	95	97
Driver-Harris	8s	1931	97	95	98½
Dubuque Elec.	6s	1942	102	102	103½
Duke-Price Pwr.	6s	1949	103½	102	104
Duquesne Lt.	6s	1949	k106½	....	....
Duquesne Lt.	5½s	1949	k105½	....	....
Durham Pub. Serv.	7s	1949	100	99	101½
East Penn. Elec.	6s	1953	105½	105	106
East Oregon Lt. & Pwr.	6s	1929	100	100	101
East. Tex. Elec.	5s	1942	k 96	....	....
Economy Lt. & Pwr.	5s	1956	98½	99	100
Edison Elec. Illum. of Boston (notes)	4½s	1928	99½	99½	100½
Edison Elec. Illum. of Bklyn.	4s	1939	93½	93	99½
Edison El. Illum. (N.Y.)	5s	1995	103½	103	105
El Paso Elec.	5s	1932	k102	....	....
El Paso Elec.	5s	1950	95½	95	96½
El. Pwr. Corp. (Germany)	6½s	1950	k 85½	85½	89½
Elec. Refrigeration	6s	1936	k103½	100½	107
Elmira Wtr., Lt. & R.R.	5s	1956	96	96	97
Empire Dist. Elec.	5s	1949	93½	92	93½
Erie Ltg.	5s	1967	99½	99	100½
Evansville G. & El. Lt.	5s	1932	99	99	100
Federal Lt. & Trac.	5s	1942	94½	93	97½
Federal Lt. & Trac.	6s	1942	k103½	....	....
Federal Lt. & Trac.	6s	1954	k 94½	93	96
Florida Power & Light	5s	1954	k 93½	93½	94
Florida Publ. Service	6s	1955	97	97	99
Florida Public Service	6½s	1949	99½	100	103
Ft. Smith Lt. & Trac.	5s	1936	78	75½	86
Ft. Worth Pwr. & Lt.	5s	1931	100	99	100½
Galveston Elec.	5s	1940	90	89	92
General Elec.	3½s	1942	87½	87	88½
Georgia Carolina Pwr.	5s	1952	89	87	89½
Ga. Lt., Pwr. & Rys.	5s	1941	89	88	92
Ga. Ry. & Elec.	5s	1932	99	98½	100½
Ga. Ry. & Elec.	5s	1949	95½	95	97
Ga. Ry. & Pwr.	5s	1954	96	96	99
Ga. Ry. & Pwr.	6s	1947	k104	....	....
Ga. Ry. & Pwr.	7s	1941	k105	....	....
German Gen. Elec.	6½s	1940	k 97½	94	99½
German Gen. Elec.	7s	1945	k 98½	95	98½
Great Cons. Elec. Pwr. (Japan)	6½	1950	k 85½	85½	86
Great Cons. Elec. Pwr. (Japan)	7s	1944	k 91½	....	....
Great Falls Pwr.	5s	1940	k104	....	....
Great Northern Pwr.	5s	1935	99½	98½	100
Great Western Pwr.	5s	1946	k 99	....	....
Great Western Pwr.	5½s	1955	99½	99	101
Great Western Pwr.	6s	1949	102½	102	103½
Great Western Pwr.	6s	1952	k102½	....	....
Hamburg Elec.	7s	1935	k 95½	94	96½
Havana Elec. R., Lt. & P	5s	1954	93½	92½	94
Holtwood Pwr.	6s	1954	104½	100	104½
Houston Ltg. & Pwr.	5s	1931	100	99	101
Houston Ltg. & Pwr.	5s	1953	95½	90½	95½
Houston Ltg. & Pwr.	5½s	1954	100½	99½	102½
Hydraulic Pwr.	5s	1951	101½	101½	102
Hydraulic Pwr.	5s	1950	101½	101½	103
Idaho Pwr.	5s	1947	97½	96	98½
Ill. Elec. Pwr.	6s	1943	102½	102	103½
Ill. Pwr.	5s	1933	k 94	....	....
Ill. Pwr.	6s	1944	k 98	....	....
Ill. Pwr. & Lt.	5½s	1954	98½	97½	99
Ill. Pwr. & Lt.	6s	1953	101½	100½	102½
Ill. Pwr. & Lt.	7s	1953	102½	102½	103½
Ind. Elec.	6s	1947	98½	98	100½
Ind. Gen. Serv.	5s	1948	97½	96½	98½
Ind. Lighting	4s	1958	83½	82½	84
Indiana & Mich. Elec.	5s	1955	98½	96	98½
Indiana & Mich. Elec.	5s	1957	99½	97½	100
Ind. Pwr.	7½s	1941	m105½	n104	n106
Ind. Service	5s	1950	92	91½	93
Ind. Service	6s	2020	87½	86½	88½
Ingersoll-Rand	6s	1935	100	....	....
Interstate Elec.	6s	1933	97½	94	98
Interstate Pwr.	6s	1944	k 97½	....	....
Interstate Pwr.	7s	1934	k101	....	....
Interstate Pub. Serv.	6s	1948	99½	98	99½
Iowa Ry. & Lt.	5s	1932	98½	97½	99½
Iowa Southern Utilities	5½s	1950	95	94	96
Jersey Cent. Pwr. & Lt.	5½s	1945	96½	95	98
Kansas City Pwr. & Lt.	5s	1952	k101½	....	....
Kansas Elec. Pwr.	6s	1937	k100	....	....
Kansas Elec. Pwr.	6s	1943	101	99½	101½
Kansas Gas & Elec.	6s	1952	k103½	....	....
Kansas Gas & Elec.	6s	2022	92½	92½	93½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMont real; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high. Tuesday, March 16. lBid, low, high, Wednesday, March 17. mLatest quotations available. n1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies		Bid Price Saturday March 13	Low 1926	High 1926
BONDS (Continued)				
Kentucky Hydro Elec	6s	1949 100½	99½	101½
Kentucky Utilities	6s	1949 100½	99½	101½
Kings Cty. Elec. L. & P.	5s	1937 103	102	103
Kings Cty. Elec. L. & P.	6s	1997 121½	120½	123
Kings County Ltg	5s	1954 99	98½	100½
Kings County Ltg	6½s	1954 108½	106	108½
Knoxville Ry. & Lt	5s	1946 95½	95½	97
LACLEDE GAS LT	5s	1934 k101	....	....
Laclede Gas Lt	5½s	1953 k104½	....	....
Laurentian Pwr	6s	1936 100	100	101
Laurentide Pwr	5s	1946 100½	100	102
Lehigh Pwr. Sec. §	6s	2026 k 95½	93	95½
Lincoln Gas & Elec	5s	1941 93½	92½	94½
Long Island Ltg	5s	1936 k100½	....	....
Long Island Ltg	6s	1954 100½	100	101½
Long Island Ltg	6s	1948 105½	104½	106
Los Angeles Gas & Elec	5s	1939 k100½	....	....
Los Angeles Gas & Elec	5½s	1943 100	99	100½
Los Angeles Gas & Elec	5½s	1947 k100	....	....
Los Angeles Gas & Elec	5½s	1949 100	99	101
Los Angeles Gas & Elec	6s	1942 103½	102½	104
Louisiana Pwr	6s	1944 99½	98½	100
Louisville Gas & Elec	5s	1952 k 99½	....	....
Louisville Gas & Elec	5½s	1954 103½	102	103½
Lower Austrian Hydro El	6½s	1944 86½	....	....
Luzerne Cty. Gas & El	5s	1948 98	97½	99½
Luzerne Cty. Gas & El	7s	1944 104½	103½	105½
Luzerne Cty. Gas & El	6s	1954 103½	102	104
MADISON RIV. PWR.	5s	1935 100½	100	101
Manila Elec	7s	1942 k108	....	....
Manila Elec. Ry. & Ltg	5s	1953 91	89½	94
Manitoba Pwr	7s	1941 k105½	103½	105½
Memphis Pwr. & Lt	5s	1948 99½	99	100½
Metropolitan Edison	6s	1952 k107	....	....
Metropolitan Edison	5s	1953 99½	96½	99½
Metropolitan Pwr	6s	1953 104½	102½	104½
Michigan Lt	5s	1946 99½	99	100½
Michigan No. Pwr	5s	1941 98½	97	99
Milwaukee El. Ry. & Lt	5s	1926 m 99½	99½	99½
Milwaukee El. Ry. & Lt	4½s	1931 97½	97	99
Milwaukee El. Ry. & Lt	5s	1951 99½	98½	100
Milwaukee El. Ry. & Lt	5s	1961 k 94½	....	....
Milwaukee El. Ry. & Lt	6s	1953 k103	....	....
Minn. Pwr. & Lt	5s	1955 96½	92	94
Minn. Pwr. & Lt	6s	1950 101½	104	105½
Miss. Power	5s	1955 93½	....	....
Miss. River Pwr	5s	1951 k99	92	94
Miss River Pwr	7s	1935 101½	102	103
Mo. Edison Elec	5s	1927 m100½	100½	100½
Mobile Elec	5s	1946 k 97½	....	....
Monongahela W. Pa. Pub. Service	5½s	1953 96½	95	97½
Montana Pwr	5s	1943 k101½	....	....
Montgomery Lt. & W.P.	5s	1943 m 93	n 86½	n 93½
Montreal Lt., Ht. & Pwr.	4½s	1932 97	97	98½
Montreal Lt., Ht. & Pwr.	5s	1933 99½	99½	101
Montreal Pub. Serv	5s	1942 94½	94	95½
Mountain States Pwr	6s	1938 99	98½	100
NASHVILLE RY. & LT.	5s	1953 97½	96½	98½
Nashville Ry. & Lt	5s	1958 92	90½	92½
Nassau Lt. & Pwr	5s	1927 99½	98½	100½
Nassau & Suffolk Ltg	5s	1945 91½	89½	91½
National Elec. Power	6s	1945 92½	92½	94
National Pwr. & Lt	7s	1972 k103	....	....
National Pub. Serv	6½s	1955 95½	94½	95½
Nebraska Pwr	5s	1949 99½	99	100½
Nebraska Pwr	6s	2022 96½	94½	96½
Nevada-Calif. Elec	6s	1946 k 99	....	....
Nevada-Calif. Elec	6s	1950 99½	98½	100
New Brunswick Pwr	5s	1937 82	81½	83
New England Pwr	5s	1951 101½	100½	102½
New Jersey Pwr. & Lt	5s	1936 98½	96½	98½
New Orleans Pub. Serv	4½s	1935 88	87	88½
New Orleans Pub. Serv	5s	1952 k 93½	....	....
New Orleans Pub. Serv	5s	1955 93½	90½	94½
New Orleans Pub. Serv	6s	1949 92	90	92½
N.Y. & Queens El. L.&P.	5s	1930 100½	100½	103½
N.Y. & Westchester Ltg	4s	2004 80½	79½	81½
N.Y. & Westchester Ltg	5s	1954 98	97½	98½
New York Edison	6½s	1941 k116½	....	....
New York Edison	5s	1944 k102½	....	....
N.Y. Gas & El. L., H.&P.	5s	1948 k104½	....	....
N.Y. Gas & El. L., H.&P.	4s	1949 90	89½	90½
N.Y. State Gas & Elec	5½s	1962 100½	100	101
Newport News & Hampton Ry., Gas & Elec	5s	1944 90	89½	91
Niagara Falls Pwr	5s	1932 k102½	....	....
Niagara Falls Pwr	6s	1932 105½	104½	106½
Niagara Falls Pwr	6s	1950 105½	105	106½
Niagara, Lock. & Ont. Pwr.	5s	1954 m 98½	n104½	n110
Niagara, Lock. & Ont. Pwr.	5s	1955 k101	....	....
Niagara, Lock. & Ont. Pwr.	6s	1958 k106	....	....
Norfolk Ry. & Lt	5s	1949 95	94	95½
No. Amer. Edison	6s	1952 k103½	....	....
No. Amer. Edison	6½s	1948 k105½	....	....
No. Amer. Lt. & Pwr	7s	1954 99½	99	100½
North Caro. Pub. Serv	5s	1934 k 93	....	....
North Caro. Pub. Serv	6s	1954 95	94½	96
North Caro. Pub. Serv	6½s	1944 99	98	100½
North Shore Elec	5s	1940 100½	98½	100½
No. Calif. Pwr	5s	1948 100½	99½	101½
No. Ind. Gas & Elec	5s	1929 99	99	100
No. Ind. Gas & Elec	6s	1952 104½	102½	105
Northern N. Y. Utilities	5½s	1949 101	100	101½
No. Ohio Pwr	7s	1935 k 94	....	....
No. Ohio Trac. & Lt	4s	1933 88	87	89
No. Ohio Trac. & Lt	5s	1956 84	84	86
No. Ohio Trac. & Lt	6s	1926 99	99	100
No. Ohio Trac. & Lt	6s	1947 k 94	....	....
No. Ontario Lt. & Pwr	6s	1931 m100	n 95½	n100½
No. States Pwr	6½s	1933 k114½	108	132
No. States Pwr. (notes)	6½s	1933 k104	102½	104
No. States Pwr	6s	1948 k103½	....	....
No. States Pwr	6s	1941 105½	105½	106½
No. States Pwr	5s	1941 k 99½	....	....
No. Tex. Elec	5s	1940 70	72	75
Northwestern Elec	6s	1935 102½	102	103½
Northwestern Pub. Serv	6½s	1948 101	99½	100½
Nova Scotia Tr. & Pwr	5s	1946 88	88	90
OHIO PWR	5s	1952 95	94	95½
Ohio Pwr	6s	1953 103½	103½	104½
Ohio Pwr	6s	2024 96½	95½	96½
Ohio Pwr	7s	1951 105½	105½	106½
Ohio Pub. Serv	5s	1954 94	92½	94½
Ohio Pub-Serv	6s	1953 101½	101	102½
Ohio Pub. Serv	7½s	1946 k112½	....	....
Ohio Pub. Serv	7s	1947 111	110½	111½
Ohio River Edison	6s	1948 k103½	....	....
Okla. Gas & Elec	5s	1950 93	93	94½
Okla. Gas & Elec	6s	1940 k 96½	....	....
Ontario Pwr. of Ningara Falls	5s	1943 100½	99½	101
Ontario Transmission	5s	1945 k 99½	....	....
Ozark Pwr. & Wtr	5s	1952 77	77	78
PACIFIC COAST PWR.	5s	1940 99½	99	100½
Pacific Gas & Elec	5s	1942 k 99½	....	....
Pacific Gas & Elec	5s	1955 m 93½	n 94	n 95½
Pacific Gas & Elec	5½s	1952 k103	....	....
Pacific Gas & Elec	6s	1941 k107½	....	....
Pacific Lt. & Pwr	5s	1942 k101	....	....
Pacific Lt. & Pwr	5s	1951 100½	100	101½
Pacific Pwr. & Lt	5s	1930 100½	99½	100½
Pacific Pwr. & Lt	5s	1953 m 96½	....	....
Parr Shoals Pwr	5s	1952 97½	95	98½
Paterson & Passaic G.&E.	5s	1949 100½	100	100½
Penn Central Lt. & Pwr	6s	1953 103	102½	105
Penn Edison	5s	1946 98	96½	98½
Penn. Elec	6s	1955 94½	92	94
Penn Elec	6½s	1954 98½	97	98½
Penn.-Ohio Edison	6s	1950 k102	98½	106
Penn Ohio Elec	6½s	1938 107	105	107
Penn Ohio Pwr. & Lt	5½s	1954 k 99½	....	....
Penn Ohio Pwr. & Lt	6s	1939 97½	97	98½
Penn Pwr. & Lt	5s	1952 k 98	97½	99
Penn Pwr. & Lt	5s	1953 98	97½	99
Penn Pwr. & Lt	6s	1953 105½	105½	106
Penn Pwr. & Lt	7s	1951 105½	105½	106½
Penn Pub. Serv	5s	1954 97½	96	98
Penn Pub. Serv	6s	1947 104	103	105
Penn Wtr. & Pwr	5s	1940 101½	101½	102½
Penn Wtr. & Pwr	5½s	1953 103½	102½	103½
Phila. Co	6s	1944 104½	103½	105
Phila. Co	5½s	1938 k 99½	....	....
Phila. Co	5s	1951 98½	97½	99½
Phila. Co	5s	1949 m104½	103½	104½
Phila. Elec	5s	1966 c103½	102½	104½
Phila. Elec	4s	1966 m 85½	84	85½
Phila. Elec	5s	1960 c102½	102	103
Phila. Elec	6s	1941 c108	107½	108½
Phila. Elec	5½s	1947 c107½	106½	107½
Phila. Elec	5½s	1953 c107½	106	107½
Phila. Elec. Pwr	5½s	1972 k100½	100¼	101
Portland Elec. Pwr	6s	1947 k102½	....	....
Portland Gen. Elec	5s	1935 100½	99½	100½
Portland Ry., Lt. & Pwr.	5s	1942 90½	88½	93
Portland Ry., Lt. & Pwr.	6s	1947 k102	....	....
Portland Ry., Lt. & Pwr.	7½s	1946 k108½	....	....
Potomac Edison	6s	1949 100	99	100½
Potomac Edison	6½s	1948 103½	103	104
Potomac Elec. Pwr	5s	1929 j100	....	....
Potomac Elec. Pwr	5s	1936 j 99½	....	....
Potomac Elec. Pwr	6s	1953 j106½	....	....
Potomac Elec. Pwr	7s	1941 j107	....	....
Power Corp. of N. Y	6s	1942 100½	101	101½
Power Corp. of N. Y	6½s	1942 104½	104	105½
Power Securities	6s	1949 k 77	....	....
Pub. Lt. & Pwr	5s	1945 69	68	73
Pub. Serv. Co. of Colo	5½s	1954 95½	95	96½
Pub. Serv. Co. of Colo	6s	1953 100½	100	101½
Pub. Serv. Co. of Colo	7s	1933 101½	101½	102½
Pub. Serv. Corp. of N.J.	5s	1959 k104½	....	....
Pub. Serv. Corp. of N.J.	6s	1944 k102	....	....
Pub. Serv. Co. of No. Ill.	5s	1956 98½	98	99½
Pub. Serv. Co. of No. Ill.	5½s	1962 103½	104	105
Pub. Serv. Co. of No. Ill.	5½s	1960 103½	104	105½
Pub. Serv. Co. of Okla.	6s	1949 100½	98½	100½
Pub. Serv. Elec. & Gas	5½s	1959 105½	103½	105½
Pub. Serv. Elec. & Gas	5½s	1964 k105	103½	105½
Pub. Util. Evansville, (Ind.)	6s	1929 k100	....	....
Puget Sound Pwr	5s	1933 99½	99	100½
Puget Sound Pwr. & Lt	5½s	1949 k 99	....	....
QUEBEC PWR	6s	1953 102½	101½	102½
Queensborough Gas & E.	5s	1952 99½	99½	100½
Queensborough Gas & E.	6s	1953 104½	104	105½
RHINE-WESTPHALIA ELECTRIC PWR.	7s	1950 k 95	93½	96
Rio de Janeiro Tram., Lt. & Pwr	5s	1935 94	93	94½
Robbins & Myers	7s	1952 m 62½	60	66½
Rochester Gas & Elec	5½s	1948 m105½	....	....
Rochester Gas & Elec	7s	1946 k112½	....	....
Rochester Ry. & Lt	5s	1954 100½	100½	101½
Rockford Elec	5s	1939 100½	99½	100½
ST. MAURICE PWR.	6½s	1953 108½	108	109½
St. Paul Gas Lt	5s	1944 100½	100½	101½
St. Paul Gas Lt	5½s	1954 101½	101	102½
St. Joseph Ry., Lt., H.&P.	5s	1937 97½	91½	97
Salt River Valley Wtr	6s	1938 k100	....	....
Salmon River Pwr	5s	1952 k103½	100½	103½
San Antonio Gas & Elec	5s	1949 96½	96	97½
San Antonio Pub. Serv	6s	1952 k103½	....	....
San Diego Cons. G.&E.	5s	1939 k100½	....	....
San Diego Cons.G.&E.	6s	1939 101½	101	102½
San Joaquin Lt. & Pwr	5s	1945 99½	98½	100
San Joaquin Lt. & Pwr	6s	1950 102½	103	104½
San Joaquin Lt. & Pwr	6s	1952 102½	99½	103½
San Joaquin Lt. & Pwr	6s	1954 101½	100½	102½
Sauda Falls	5s	1955 k 94½	94½	96
Savannah Elec. & Pwr	7½s	1941 k104½	....	....
Saxon Pub. Wks. (Germany)	7s	1945 k 95½	....	....
Scranton Electric	5s	1937 102	101½	102½
Seattle Elec	5s	1930 101½	100½	101½
Seattle Elec	5s	1929 99½	99½	100½
Seattle Elec	5s	1939 93	92½	94½
Seattle Ltg	5s	1949 91½	90½	92½
Shawinigan Wtr. & Pwr.	5s	1934 101½	100	101½
Shawinigan Wtr. & Pwr.	5½s	1950 104½	103½	104½
Shawinigan Wtr. & Pwr.	6s	1950 105	104½	105½
Sheboygan Elec	5s	1946 95½	94½	96½
Siemens & Halske	7s	1928 k 99	96	100
Siemens & Halske	7s	1935 k 97	93	98
Sierra & San Fran. Pwr.	5s	1949 k 76	....	....
Sierra & San Fran. Pwr.	6s	1949 k 76	90	91
Sioux City Gas & Elec	6s	1947 102	101½	102½
Sioux City Gas & Elec	6s	1949 102	102	103½
So. Caro. Gas & Elec	6s	1942 78	78	90
So. Caro. Gas & Elec	6s	1932 65	75	80
Southeast Pwr. & Lt. (ex-warranto)	6s	2025 k 92	89	93
So. Cal. Edison	5s	1939 k100½	....	....
So. Cal. Edison	5s	1944 99½	98	99½
So. Cal. Edison	5½s	1944 103½	103	104
So. Cal. Edison	6s	1943 103	102	104
So. Cal. Edison	6s	1944 k105½	....	....
So. Cities Utilities	5s	1931 99	99	102
Southern Colo. Power	6s	1947 k 98½	....	....
So. Ind. Gas & Elec	6s	1947 k 97½	....	....
Southern Pwr	5s	1930 100½	100	101
So. Public Utilities	5s	1943 100½	100	101½
So. Sierras Pwr	6s	1936 k103½	....	....
So. Utilities	6s	1933 m102	n 97½	n102½
So. Wisconsin Pwr	5s	1938 92	91	93
Southwestern Gas & E.	5s	1932 97	97	98½
Southwestern Gas & E.	6s	1957 98	97½	99½
Southwestern Lt. & Pwr.	6s	1937 98½	98	99½
Southwestern Power	6s	1944 96½	96½	98
Southwestern Pwr. & Lt.	5s	1943 94½	94	96
Southwestern Pwr. & Lt.	6s	2022 94	94	96
Southwestern Pub. Serv.	6s	1945 94½	94	96
Southwestern Utilities	8s	1936 96	94	96
Springfield Ry. & Lt	5s	1926 99½	99½	100½
Standard Elec. of Cal	5s	1939 100	99½	101
Standard Gas & Elec	6s	1935 k 99½	....	....
Staten Island Edison	6½s	1953 105½	106	107½
Superior Water, Lt. & Pwr.	4s	1931 94½	94½	95½
Syracuse Ltg	5s	1951 103½	100	100½
Syracuse Ltg	5½s	1954 103½	103½	104½
TAMPA ELEC	5s	1933 k 99	....	....
Tenn. Elec. Pwr	6s	1947 k105½	....	....
Tenn. Pwr	5s	1962 96	96	97
Tex. Pwr. & Lt	5s	1937 98½	98½	100
Tex. Pwr. & Lt	6s	2022 96½	95½	97
Tide Water Pwr	6s	1942 101	100	101½
Tide Water Pwr	7s	1937 100½	100	101½
Toho Elec. Pwr. (Japan)	7s	1955 k 91½	....	....
Tokyo Elec. (Japan)	6s	1928 k 98½	....	....
Toledo Edison	5s	1947 99½	100	100½
Toledo Edison	7s	1941 k108½	....	....
Toledo Gas, Elec. & Htg.	5s	1935 98	98	100½
Toledo Tr., L.&P. (notes)	5½s	1930 k 98½	....	....
Topeka Edison	5s	1930 99	99	100
Topeka Ry. & Lt	5s	1933 94½	94½	96½
Trenton Gas & Elec	5s	1949 96½	100½	101
Tri-City Ry. & Lt	5s	1930 k 98½	....	....
Twin State Gas & Elec	5s	1953 95½	95	96½
Twin State Gas & Elec	5½s	1945 98	98	99
Tyrol Hydro-Elec. Pwr	7½s	1955 k 97	....	....
UJIGAWA ELEC PWR.	7s	1945 92½	92	94
Union Elec. Lt. & Pwr	5s	1932 100½	100½	102½
Union Elec. Lt. & Pwr	5s	1933 m100½	100½	101½
Union Elec. Lt. & Pwr	5s	1954 99½	99½	101
Union Elec. Lt. & Pwr	5½s	1954 m101½	100½	102½
United Elec. of N.J	4s	1949 87½	87½	89
United Elec. Lt. & Pwr	4½s	1929 98	98	99½
United Gas & Elec	6s	1945 m101½	n 96	n101
United Lt. & Pwr. (notes)	5½s	1928 99½	99	100½
United Lt. & Pwr	5½s	1959 95½	96	97½
United Lt. & Pwr	6½s	1974 96½	96	98½
United Lt. & Rys	5s	1932 k 94½	....	....
United Lt. & Rys	6s	1926 99½	100	101½
United Lt. & Rys	6s	1952 100	99	100½
United Lt. & Rys	6s	1973 89½	89½	92
United Pwr. & Lt	6s	1944 102½	102	103½
United Water, G. & E.	5s	1941 94½	94	95
Utah Lt. & Trac	5s	1944 96½	86½	89½
Utah Pwr. & Lt	5s	1944 k 96½	....	....
Utah Pwr. & Lt	6s	1944 103	102½	104½
Utah Pwr. & Lt	6s	2022 93	88½	94½
Utica Elec. Lt. & Pwr	5s	1950 101½	100½	101½
Utica Gas & Elec	5s	1957 101½	100½	102½
Utica Gas & Elec	5½s	1949 104	103½	104½
VERMONT HYDRO-ELEC	6s	1929 100½	100	101
Vicksburg Lt. & Trac	5s	1932 94½	93½	93½
Virginian Pwr	5s	1942 96	88	97
Virginian Pwr	6½s	1954 m103½	103	104½
Virginia Ry. & Pwr	5s	1943 97½	97½	99
Virginia-Western Pwr	6s	1953 102	101½	102½
WAGNER EL. MFG	7s	m101½	100½	101½
Washington Coast Util	6s	1941 103	102½	103½
Washington Ry. & Elec	4s	1951 j 81½	....	....
Washington Ry. & Elec	6s	1933 j 103	....	....
Washington Wtr. Pwr	5s	1939 101½	101½	102½
West Penn Pwr	5s	1963 101	99½	102
West Penn Pwr	5s	1946 100½	99½	102
West Penn Pwr	5½s	1953 k105½	....	....
West Penn Pwr	7s	1946 k106½	....	....
W. Va. Lt., Ht. & Pwr	6s	1929 102½	101	102½
West Virginia Utilities	6s	1935 97½	95½	97½
W. Va. Water & Elec	6½s	1942 103	102½	104
Westchester Ltg	5s	1950 102½	102½	103½
Western Elec	5s	1944 k101½	....	....
Western N. Y. Utilities	5s	1946 2	96½	98
Western Pwr	6½s	1954 100½	100½	102
Western Pub. Service	6s	1950 98½	98	99½
West States Gas & Elec	5s	1941 99	98½	99½
West States G.&E. (notes)	6s	1937 94½	94½	96
West States Gas & Elec	6s	1947 k100½	....	....
West United Gas & El	5s	1950 102	101½	102
West United Gas & El	6s	1950 m102	n100	n102½
Westphalia Un. Elec. Pwr	6½s	1950 m 98½	....	....
Westinghouse El. & Mfg.	7s	1931 k105½	....	....
Wheeling Elec	5s	1941 99	99	100
Wichita R. R. & Lt	5s	1932 85	83	88
Winnipeg Elec	6s	1954 96½	96	97½
Wisconsin Elec. Pwr	5s	1954 99	98½	99½
Wisconsin Gas & Elec	5s	1952 k 99½	....	....
Wis.-Minn. Lt. & Pwr	5s	1944 k 97	....	....
Wisconsin Pwr., Lt. & Ht	5s	1946 92	92	93
Wisconsin Pub. Service	6s	1952 101½	101	102½
Wis. Ry., Lt. & Pwr	5s	1933 96	89	93½
Wis. River Pwr	5s	1941 93½	92½	94
Wolverine Pwr	7s	1943 101	100	101½
YADKIN RIVER PR.	5s	1941 k100½	....	....
Yarmouth Lt. & Pwr	5s	1937 83	83	87
Yarmouth Lt & Pwr	8s	1951 99	99	102

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Tuesday, March 16. lBid, low, high, Wednesday, March 17. mLatest quotations available. n1925.

Manufacturing and Markets

Why There Are Two Electrical Codes

Difference Between the "Fire" Code and the "Casualty" Code—How They Have Been Made American Standards—Procedure for Changing the Rules

By S. L. Nicholson
Chairman Uniform Code Committee, Electrical Manufacturers' Council

THERE has long been much confusion in the minds of many electrical men as to why there are two electrical codes and what they are for and how they differ. The "National Electrical Code" and the "National Electrical Safety Code"—are both incorporated in the uniform electrical ordinance which has been drawn up under the auspices of the Electrical Manufacturers' Council for general adoption by the municipalities of the United States. Why was not the data in them segregated into a single code, thereby simplifying regulations and inspections? This question is almost invariably asked by any one who studies the uniform ordinance, and the object of this article is to answer briefly.

THIS is the second of a series of articles written by Mr. Nicholson at the request of the ELECTRICAL WORLD to picture in simple form the plan under which the various functions of code, test, inspection and regulation of electrical wiring installations are now organized in the electrical industry. The first subject, "The Need for a Uniform Ordinance," was treated in the ELECTRICAL WORLD of Feb. 27. Other articles to follow at short intervals will carry this discussion forward in logical sequence. Since Mr. Nicholson has been one of the outstanding leaders in this work of organizing the procedure under which the manufacturing branch of the electrical industry is operating in the development, maintenance and application of the codes, what he writes on these subjects should be of especial interest to every electrical man.

The "Fire" Code

The National Electrical Code is a fire code, consisting exclusively of rules and regulations covering electrical installations with a view to reducing fire hazards. It is mainly the work of those interested in fire insurance risks and was drawn up originally in 1897 by the "National Conference on Standard Electric Rules," which consisted of various insurance, electrical, architectural and allied interests. This conference later disbanded, and the code has ever since been in charge of the National Fire Protection Association, a body composed of representatives from organizations of insurance companies, public utilities, builders, manufacturers, electrical dealers and contractors, inspectors and many other interests.

The National Fire Protection Association revised the code periodically to meet changing conditions, and each revision was published by the National Board of Fire Underwriters and distributed to the various insurance bureaus and exchanges for use as guiding rules for local insurance inspectors. It was also supplied to state and municipal inspectors.

The "Casualty" Code

The National Electrical Safety Code is a casualty code and was drawn up to provide regulations for the installation of electrical material with a view to preventing injuries to human beings. It recognizes fire as a source of danger, but it also covers other potential hazards, such as electric shock, blows from moving mechanisms, etc. This code originated with the United States Bureau of Standards. It was first published in 1914 as a guide to states and municipalities in preparing various laws and ordinances, with particular reference to safety rules and regulations in connection with the workmen's compensation laws and to assist public utility commissions.

Because of the broad field it is designed to cover, the National Electrical Safety Code is very general in its provisions, and in order to provide regulations covering specific equipment, supplementary safety standards are prepared by the Electric Safety Conference, an association of representatives from national organizations interested in questions affecting accident hazards arising from the design, construction, installation and use of electrical materials. Each standard of the Electric Safety Conference covers a particular group of electric material, such as oil circuit breakers, switches, rotating electrical machinery, industrial control equipment, etc.

The most important difference between the two codes lies in the fact that the fire code can be very specific in its regulations, whereas the human judgment plays a large part in the application of the safety code. For example, it is easy to determine by test the safe carrying capacity (from a fire hazard standpoint) of each size and type of knife switch. When the facts are once ascertained, fire protection rules covering the installation of switches can be laid down and strictly applied under all conditions.

When an electrical appliance is viewed from the standpoint of human safety, however, no such definiteness is practical. For example, a given switch may be regarded as perfectly safe when mounted where it is properly accessible only to an electrical expert, satisfactorily safe when mounted where it is properly accessible only to the operator of the machine it controls, but hazardous where it is accessible to any one.

In consequence, inspections under the fire code can be ordinarily carried out by rigidly applying definite rules; but inspections under the casualty code must take into consideration the location of the material and the class of people having access to it. This makes the use of two separate codes necessary

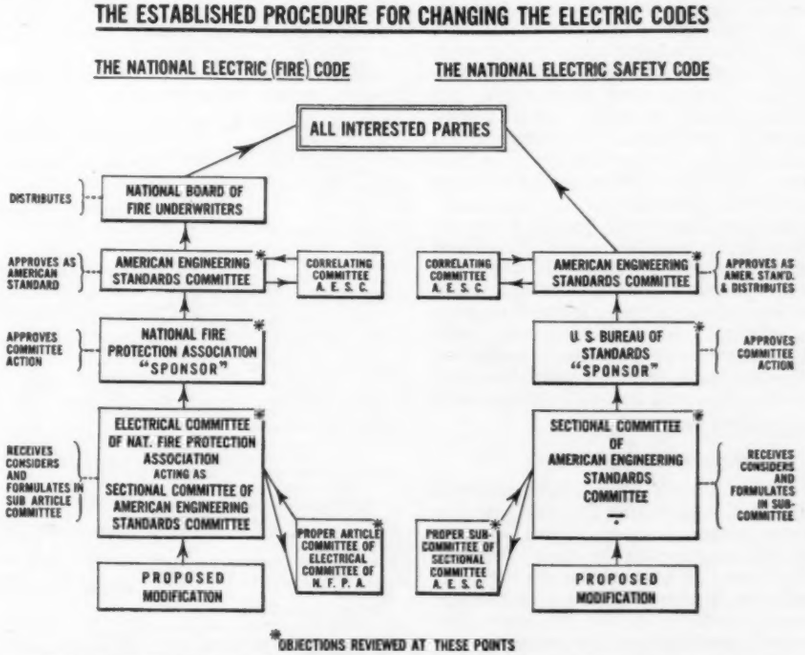

THE ESTABLISHED PROCEDURE FOR CHANGING THE ELECTRIC CODES
THE NATIONAL ELECTRIC (FIRE) CODE
THE NATIONAL ELECTRIC SAFETY CODE
ALL INTERESTED PARTIES
DISTRIBUTES
NATIONAL BOARD OF FIRE UNDERWRITERS
APPROVES AS AMERICAN STANDARD
AMERICAN ENGINEERING STANDARDS COMMITTEE
CORRELATING COMMITTEE A. E. S. C.
APPROVES COMMITTEE ACTION
NATIONAL FIRE PROTECTION ASSOCIATION "SPONSOR"
RECEIVES CONSIDERS AND FORMULATES IN SUB ARTICLE COMMITTEE
ELECTRICAL COMMITTEE OF NAT. FIRE PROTECTION ASSOCIATION ACTING AS SECTIONAL COMMITTEE OF AMERICAN ENGINEERING STANDARDS COMMITTEE
PROPER ARTICLE COMMITTEE OF ELECTRICAL COMMITTEE OF N. F. P. A.
PROPOSED MODIFICATION
CORRELATING COMMITTEE A. E. S. C.
AMERICAN ENGINEERING STANDARDS COMMITTEE
APPROVES AS AMER. STAN'D. & DISTRIBUTES
U. S. BUREAU OF STANDARDS "SPONSOR"
APPROVES COMMITTEE ACTION
SECTIONAL COMMITTEE OF AMERICAN ENGINEERING STANDARDS COMMITTEE
RECEIVES CONSIDERS AND FORMULATES IN SUB-COMMITTEE
PROPER SUB-COMMITTEE OF SECTIONAL COMMITTEE A. E. S. C.
PROPOSED MODIFICATION
* OBJECTIONS REVIEWED AT THESE POINTS

CHART OF PROCEDURE FOLLOWED IN CHANGING ELECTRIC CODES, METHOD OF APPROVAL AND DISTRIBUTION AND RELATION OF THE CODES

under present conditions, but the tendency is in the direction of simplification, and already certain safety rules are being merged into the fire rules.

NATIONALIZING THE TWO CODES

When the Electrical Manufacturers' Council prepared its uniform electrical ordinance, it recognized the excellence of these two codes and planned to incorporate them bodily into this ordinance. Upon investigation, however, it appeared that neither in its existing form was entirely suitable to be adopted by municipalities and enforced by police power. Owing to the special purposes for which they had been created, both codes had certain limitations, and before they were applicable for general use they had to be nationalized in character and drawn so as to serve all interests affected—the public, the insurance companies, the builders and the electrical industry as a whole.

Fortunately, means were at hand whereby this nationalization of the codes could be effected, namely, by having them approved under the procedure of the American Engineering Standards Committee, whose particular function is to receive any proposed set of standards, determine if all parties at interest have been properly represented in its preparation and signify by formal approval that the proposed standards are fitted for nation-wide acceptance. Both electrical codes were, therefore, submitted to the American Engineering Standards Committee for its consideration and approval.

In accordance with the rules of procedure laid down by the American Engineering Standards Committee, the National Fire Protection Association, which had been responsible for the National Electrical (fire) Code in the past, was made "sponsor" for a revision of this code, and a sectional committee was formed consisting of representatives of federal, state and city governments, consumers, engineering societies, inspectors, public utilities, insurance companies and electrical dealers, contractors and manufacturers. Each provision of the code was considered by a sub-committee of this sectional committee, and thus when the code was finally prepared by the Fire Protection Association it represented the consensus of opinion of the best minds in the United States qualified to pass on the subject.

A similar course was pursued in connection with the National Electrical Safety Code, the Bureau of Standards and the Electric Safety Council being made sponsors for their respective portions of this code. Both codes were finally approved by the American Engineering Standards Committee and were then inserted in the uniform electrical ordinance.

MODIFYING THE CODES

Provisions have been made through the A.E.S.C. procedure for the revision of these codes as need arises so that they will represent the best practice at all times. When, owing to new developments in the electric art, a change appears desirable in the fire code, the proposed modification is presented to the electrical committee of the National Fire Protection Association, which refers it to the proper sub-committee. It is studied by this sub-committee, and if it is considered desirable, a rule embodying the modification is sent to the electrical committee of the National Fire Protection Association, which, if it approves, sends it in turn to the main association. If this association approves the modification, it inserts it into the code and, as a sponsor, submits it to the American Engineering Standards Committee. Upon receiving the latter organization's approval, the new rule is published by the National Board of Fire Underwriters and is distributed to all parties at interest.

The proposer of a change in the code has, therefore, four opportunities of presenting his views: (a) before the proper sub-committee of the electrical committee of the National Fire Protection Association; (b) before the main electrical committee of the National Fire Protection Association; (c) before the National Fire Protection Association itself at the time when the report of the electrical committee is being passed upon; (d) before the American Engineering Standards Committee at the time the final approval of the report is being considered. Thus a careful consideration of all interests is insured and if a proposed change is rejected by the committee responsible for the preparation of the rules, the proposer has ample opportunity to appeal from the decision. A similar procedure has been set up for making changes in the National Electrical Safety Code.

Under this arrangement a change in either code can be effected in about a year, which is considered the shortest reasonable time to make changes in rules and regulations affecting the general public. As soon as changes in either code have been approved by the American Engineering Standards Committee, they are automatically adopted by the municipalities using the uniform electrical ordinance as *prima facie* evidence that work done in accordance with them is in conformity with the most improved methods of construction for safety to life and property.

Exports of Motors Show Increase in January

Foreign shipments of electrical goods from the United States during January, 1926, totaled $7,144,842, which is approximately $1,750,000 less than the

Value of Electrical Exports for January, 1926, Compared with Corresponding Month in 1925

(Issued by Bureau of Foreign and Domestic Commerce)

Articles	January 1925	January 1926
Generators:		
Direct-current:		
Under 500 kw.	$70,169	$67,312
500 kw. and over	4,340	16,992
Alternating-current:		
Under 2,000 kva.	14,451	23,956
2,000 kva. and over	230,953	73,087
Steam-turbine generator sets	30,814	74,332
Accessories and parts for generators	107,466	41,201
Self-contained lighting outfits	119,558	85,747
Batteries:		
Flashlight batteries	84,374	103,286
Other primary batteries	79,607	114,251
Storage batteries	204,434	226,363
Transforming or converting apparatus:		
Power transformers	253,407	183,624
Other transformers	125,010	89,688
Rectifiers, double-current and motor generators, dynamotors, sychronous and other converters	144,479	119,930
Transmission and distribution apparatus:		
Switchboard panels, except telephone	143,079	511,407
Switches and circuit breakers over 10 amp	249,088	242,859
Fuses and fuse blocks	30,625	27,579
Watt-hour and other measuring meters	38,578	26,647
Volt, watt and ampere meters and other recording, indicating and testing apparatus	162,539	195,678
Lightning arresters, choke coils, reactors and other protective devices	78,586	43,161
Motors, starters and controllers:		
Motors, under 1 hp.	140,713	184,932
Stationary motors:		
1 to 200 hp.	134,244	209,052
Over 200 hp.	18,747	146,455
Railway motors	51,466	57,016
Electric locomotives:		
Railway	118,509	68,206
Mining and industrial	21,260	20,648
Starting and controlling equipment for:		
Industrial motors	62,213	85,736
Electric railway and vehicle motors	6,134	12,508
Portable electric tools	*	19,196
Accessories and parts for motors	165,449	214,593
Electrical appliances:		
Electric fans	92,434	67,755
Electric lamps:		
Metal-filament	111,184	117,297
Other electric lamps	26,085	18,570
Flashlights	99,108	136,077
Searchlights and projectors	41,852	49,656
Motor-driven household devices	112,464	125,685
Domestic heating and cooking devices	91,595	143,122
Industrial electric furnaces and ovens	29,130	10,545
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	111,494	110,780
Signal and communication devices:		
Radio apparatus	784,657	†
Transmitting sets and parts	*	16,601
Receiving sets	*	139,856
Tubes	*	46,616
Receiving-set components	*	125,227
Receiving-set accessories	*	171,359
Telegraph apparatus	138,529	49,726
Telephone apparatus:		
Magneto telephones	12,448	7,447
Other telephones	26,045	16,940
Telephone switchboards	7,580	7,102
Other telephone equipment	218,410	199,141
Railway signals, switches and attachments	127,343	38,325
Bells, buzzers, annunciators and alarms	12,361	18,442
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	200,287	149,702
Insulating material	149,455	122,053
Metal conduit, outlet and switch boxes	45,606	67,245
Sockets, receptacles and lighting switches	112,461	137,042
Electric lighting fixtures, interior and street	81,683	131,846
Other wiring supplies and line materials	68,577	93,724
Other electrical apparatus not elsewhere stated	732,117	640,089
Rubber and friction tape	*	15,704
Globes and shades for lighting fixtures	38,369	47,869
Electrical glassware except for lighting	19,120	35,615
Electrical porcelain:		
For less than 6,600 volts	130,773	50,079
For 6,600 volts and over	703	62,137
Carbons, carbon brushes and electrodes:		
Electrodes for electric furnaces	51,656	171,517
Other carbon products	200,152	57,314
Insulated wire and cable (iron and steel)	26,420	29,679
Copper, bare wire	305,071	116,984
Copper, insulated wire and cables	332,825	314,532
Total electrical machinery and apparatus and supplies	$7,428,286	$7,144,842

*Not separately stated prior to Jan. 1, 1926.
†Discontinued from Jan. 1, 1926.

total for December and about $283,000 below the figure for January a year ago, according to the Electrical Division of the Department of Commerce. On the whole, the staple lines continue to show a satisfactory trend. An increase was noted in the value of every one of the four motor classes, the heaviest being in the over-200-hp. stationary-motor class, in which the total for January of this year was $146,455 as compared with $18,747 last year. A gain was also registered in the cases of stationary motors of from 1 hp. to 200 hp., and in the fractional-horsepower class there was an increase of over $44,000 as compared with a year ago, while the number of units shipped increased by more than 5,300. Shipments of mining and industrial locomotives were practically the same in value as a year ago, though the number of units shipped was double.

The expected falling off in exports of radio during January was more marked than was the case a year ago, the total for January, 1926, being approximately $285,000 below the corresponding month of last year. Shipments of motor-driven household devices in January of this year were $125,685 as compared with $112,464 a year ago, while domestic heating and cooking devices for the same periods were respectively $143,122 and $91,595. Substantial gains were made in conduit, sockets, lighting switches, lighting fixtures, miscellaneous wiring supplies and glassware for lighting fixtures. The values of the complete electrical exports for January are shown classified in the accompanying table.

Survey of Refrigeration Prospects in New England

Sales of electrical refrigerating equipment will promote the interests of companies engaged in the development of electrical power to an extent comparable with the benefit accruing to petroleum companies through the rapid use of automobiles, according to an opinion expressed by a number of representatives of manufacturers at a meeting of the New England Division of the National Electric Light Association Merchandising Bureau held March 9. New England is said to offer a particularly attractive field for the merchandising of this type of equipment. A prominent manufacturing firm which records eighty thousand installations for the entire country during 1925 reports the addition of many salesmen to its force and plans a field organization of about 300 in the New England district for this year. Another prominent manufacturer is preparing to distribute twelve thousand units in 1926, special interest being taken in house and residence installations.

Payments show an encouraging trend toward the cash basis. From one source about 90 per cent of the sales are for cash, while in another case over 75 per cent of the total sales are on a cash basis. Equipment installations only, without boxes, are reported to show a falling off in volume, and one company says that about 50 per cent of its sales are on this plan. In one eastern Massachusetts city it is reported that more than three hundred class A prospects are listed by a central-station company. In the northern districts, hitherto generally considered out of range for sales, the field has already proved very encouraging. Much of the success of selling this equipment is attributed to cooperation between central-station companies and manufacturers and, in no small measure, to the favorable trend of the power market. Further gains are expected to result from widespread advertising and well-organized plans for educating the public in the advantages of using electrical refrigeration.

New England Credits Good

Credits in the Northeastern electrical field are in better condition than a year ago, according to Charles A. Kane, secretary of the New England Electric Club, Boston, who recently spoke before the Boston Electrical Dealers' Association. Nothing in the recent price break in the stock market, Mr. Kane said, should cause uneasiness in the electrical industry. If the European situation was better, business would be still more satisfactory in this country, the speaker pointed out in comparing financial conditions here with those prevailing immediately after the Civil War. Following a tribute to the stabilizing influence of the Federal Reserve system, the speaker stated that the principal element in future uncertainty is the rapid growth of installment buying, which should not be carried to the point of dangerous inflation.

Business Conditions

AN ACTIVE diversified business is the classification applied to the electrical market by a prominent manufacturer. Sales are in good volume, although inquiries from industrial plants are not in the large volume previously recorded. Building construction continues at a high rate throughout the country, and central-station line construction has resulted in a steady demand for transmission-line supplies. Many purchases of high-tension switching equipment as well as distribution equipment are reported as made by holding companies for their Southern properties.

In the New England district power equipment sales are active, and the volume of small motors has shown a gain. There is a steady interest in control apparatus, industrial electric heating furnaces are selling in good volume, and transmission-line supplies are in demand. Industrial business is somewhat unsteady in the New York district, though a very active diversified business is reported.

In the Southeast sales are spotty, but the industrial field is active, particularly the textile-mill group. Several steam-turbine sales and inquiries are reported, and central-station construction is sustaining the demand for pole-line materials. Industrial plants are generally busy in the Middle West, and several manufacturers report sales in February as one of the best months in nearly two years. On the Pacific Coast construction on a large scale has been started in the Puget Sound district, and substation equipment contracts for $32,000 have been awarded by the city of Tacoma. A number of motors, a 2,500-kw. and a 5,000-kw. turbo-generator unit have been purchased by lumber mills, and good inquiries are also being received from such sources.

Non-Ferrous Metal Market Stronger Except for Lead

Purchase of lead in large volume following the reduction to 8.20 cents New York featured the non-ferrous metal markets. Zinc and copper likewise showed strength on Tuesday and Wednesday, although the volume of business during the week has been only moderate. The market appears firmer. Although some sellers were willing to take business at 14¼ cents delivered for copper during most of the week, others have been holding firmly at 14¼ cents and have done only a limited business.

Following the reduction in the contract price of lead made by the American Smelting & Refining Company last Wednesday, which brought the New York price to 8.40 cents, the market continued inactive, and a further reduction to 8.20 cents was made on Friday, March 12. London, however, advanced prices on each of the last four days, and this stronger trend has given a distinctively better tone to the domestic market. A fair tonnage was sold on Saturday, and on Monday producers were flooded with inquiries, many of which resulted in sales on that day and on Tuesday. As a result the total volume of lead sales for the week has been the greatest in several weeks, with practically all sellers sharing in the business. With producers not pressing zinc on the market, prices have strengthened during the last week. The tin market has become more active, and many consumers who have held off for some time have come into the market.

NEW YORK METAL MARKET PRICES

	Mar. 10, 1926 Cents per Pound	Mar. 17, 1926 Cents per Pound
Copper, electrolytic	14¼	14¼–14.20
Lead, Am. S. & R. price	8.40	8.20
Antimony	19¾	19
Nickel, ingot	35	35
Zinc, spot	7.70	7.80
Tin, Straits	64¼	66
Aluminum, 99 per cent	28	28

Base copper price March 10, 1926, 16½ cents

Buying Unsteady in New York District—Volume Good

Industrial buying in the New York district has been somewhat unsteady, although the market generally appears to be recovering from the slow period which occurred during the early part of this month. One prominent manufacturer reports a very active diversified business, with a total volume of sales so far that is considerably ahead of the same period last year. Manufacturers of control equipment are more pessi-

mistic, and although a slight improvement is reported in some instances, the general trend of business in this line seems to have been somewhat poorer than was anticipated.

Central-station buying is active in all lines, with a large total volume of small and medium-sized orders. One order for oil circuit breakers, exceeding $100,000 was placed by a local public utility company. High-tension switching equipment is also in demand, with a large proportion of this apparatus being ordered by holding companies for installation on Southern properties. Jobbers report a weak market generally, but an improvement in the demand for appliances is noted.

Sales in New England District in Steady Volume

Activity in power equipment sales in the New England district has increased and the volume of small motors shows a slight gain over that recorded for the previous week. A prominent manufacturer reports a steady interest in control apparatus and another records a number of single orders for the larger sizes, ranging from 50 hp. up. Sales of industrial electric heating furnaces are reported in good volume, and several interesting installations include four units of 30-kw. capacity for Ohio, one 60-kw. installation for southern New England and one for Indiana.

Transmission line supplies are receiving attention and bids have been submitted for supplies for a line in southern New Hampshire, and a number of substation additions and line extensions have reached the stage where equipment will be purchased shortly. Electric refrigeration sales are active, and oil-burning equipment is selling well, in fact better than for the corresponding period last year. A quickening interest is reported in weatherproof wire and general supplies for new construction. Major household electric appliance sales show a gain over last week.

Industrial Plants Generally Busy in Middle West

Merchandising and building activity in the Middle West show no particular slackening, and industrial plants are generally busy. Reports from manufacturers show that February was one of the best months in nearly two years. A manufacturer of pole-line hardware states that February was the largest in volume of sales in the past twelve months. The employment situation is getting better, last month showing an increase in the number of persons employed of about 1.6 per cent. The various utility companies which have been quite busy with construction work throughout the winter season—a condition which was more emphasized this year—are getting ready for spring construction. Distribution equipment is much in demand, and some apparatus is being purchased. Orders included more than 8,000 watt-hour meters, a complete condensing equipment for use with a 90,000-kw. turbo-generator unit, incandescent lamps valued at $250,000, four electric vehicles and approximately 2,500 cedar poles. Jobbers' sales continue good with an optimistic outlook for the spring business.

Business Spotty in Southeast—Textile Mills Active

A slight falling off in the volume of business is reported in the Southeast with general conditions somewhat spotty. There is a good activity in the industrial field, particularly among textile mills. One large mill electrification contract was closed last week, and there are two others in immediate prospect. The proposed construction of two new mills in north Georgia was also recently announced. Construction by both large and small central-station companies and municipalities is sustaining the demand for pole-line materials, with the number of orders fairly well distributed among all classes. Steam-turbine equipment is quite active, one manufacturer reporting the receipt of an order for one 15,000-kw. unit and another order for a 1,000-kw. unit, both for installation in south Georgia towns. An order for an additional 1,000-kw. unit is expected to be placed within the next few days. Purchases of distribution transformers by Florida power companies for immediate delivery have been very heavy during the past two weeks.

Sales campaigns by central-station companies are sustaining the very good movement of socket appliances, and washing machines and vacuum cleaners are selling in good volume.

Power Company Construction Active on Pacific Coast

Ambitious programs of enlargements and extensions which the central-station companies in the Puget Sound district of the Pacific Coast have been developing have reached fruition, and construction activities on a large scale are starting. The work proposed involves an increase in capacity of the first unit of the Baker River plant from 40,000 hp. to 50,000 hp. The city of Seattle contemplates building two substations, one scheduled to begin soon, the other during late summer. The city of Tacoma has awarded contracts for $32,000 worth of substation equipment. Generating equipment is reported in active demand. A 2,500-kw. turbo-generator unit was sold to a lumber company, a 5,000-kw. unit to another mill, as well as a number of motors. An inquiry has also been received for a 1,000-hp. motor installation. Power company inquiries include pole-line hardware and construction tools, as well as two carloads each of 35-ft. and 40-ft. poles.

New building construction has been held in abeyance with a consequent decrease of business in staple lines owing to the prediction of a carpenters' strike. Railroad business is good and consists largely of general wiring supplies, and sales of rubber-covered wire are in large volume. Safety switches are in good demand with competition keen.

Activities of the Trade

Servel Plans Recapitalization with Control of Electrolux

In a letter to the stockholders, Hamilton G. Scott, chairman of the board of directors of the Servel Corporation, New York, points out the necessity for raising additional capital and the plan for recapitalization, and in referring to the growth of the company's business says:

"Your corporation has recently completed an arrangement whereby it will control the operations of the Electrolux Servel Corporation, which has acquired the United States and Cuban patents and Canadian licenses covering processes of domestic and commercial refrigeration without moving parts known as Platen-Munters (Swedish) system. . . . Your corporation owns one-half of the common stock of the Electrolux Servel Corporation and all of its preferred stock. This arrangement will enable your corporation to cover the entire domestic and commercial refrigeration field in its operations with both electric light and power companies and gas companies throughout the entire United States, Canada and Cuba." (The Electrolux refrigerator was described on page 1161 of the Dec. 5 issue of ELECTRICAL WORLD.)

The new corporation, which is to be organized under the laws of Delaware, will acquire all of the assets, good will and properties of the present company and will have an authorized capital of 1,000,000 shares of voting capital stock without par value and all of one class. The new financing, which has been arranged for upon consummation of the plan submitted to the stockholders, will be in the form of $5,000,000 of five-year 6 per cent convertible notes to be dated April 1, 1926. The notes will be convertible at the option of the holders at any time into common stock of the new company at $25 per share, subject to adjustment.

Detroit Stoker Company Reports Large Increase in Sales

In the past five years the sales of Detroit underfeed stokers by the Detroit Stoker Company, General Motors Building, Detroit, have increased 744 per cent. As a result of this rapid increase in business the company found much larger quarters necessary and two years ago moved its works from Detroit to Monroe, Mich., into a plant where its production capacity could be trebled. Additions and extensions to this plant soon became necessary, and the company has now just completed a large new foundry, pattern shop and storage at Monroe, in which there is being installed the most up-to-date automatic foundry equipment. In commenting on the company's rapid growth, W. H. Rea, the president, pointed out that mechanical stokers were never in wider demand than at present.

The Square D Company, Detroit, manufacturer of electrical safety devices, announces the following changes in its sales staff: G. E. Daub has be-

come a member of the sales force in the Atlanta territory, with headquarters at Birmingham; Roy L. McCreary is now a salesman in the Cleveland territory, with headquarters at 715 Hippodrome Building, Cleveland; J. F. O'Hara, who was with the company several years ago, has returned as a salesman in the Detroit territory, and C. L. Hull has been appointed Eastern district sales manager with supervision over the Baltimore, Philadelphia, New York, Springfield, Boston and Syracuse territories.

The Cutler-Hammer Manufacturing Company, Milwaukee, has opened a new sales office in the Healey Building, Atlanta. This office will take care of the trade in North Carolina, South Carolina, the eastern section of Tennessee, Georgia, Florida, southern Alabama and Mississippi. A. C. Gibson, formerly of the Philadelphia office, is in charge. The General Machinery Company, Birmingham, will continue to serve the trade in the northern half of Alabama.

The American Hoist & Derrick Company, St. Paul, has recently opened another branch office at 1943 Railway Exchange Building, St. Louis, with Ward B. Maurer in charge.

The Amboy Lighting Company, 193 Smith Street, Perth Amboy, N. J., jobber, announces that since March 1 a branch store has been opened at 163 East Second Street, Plainfield, N. J.

The Chicago Pump Company, Chicago, announces that since March 1 the Monahan Pump Equipment Company, 200 Devonshire Street, Boston, headed by Joseph J. Monahan, has become its eastern New England sales agent for its entire line of pumps.

The Packard Electric Company, Warren, Ohio, manufacturer of transformers and automotive cables, announces the appointment of the H. N. Muller Company, Pittsburgh, as its agent in the Pittsburgh territory. Henry Muller is head of the H. N. Muller Company and H. E. Ransford is associated with him.

The Cameron Electrical Manufacturing Company, Ansonia, Conn., manufacturer of commutators, announces the opening of a New York sales office in the Hudson Terminal Building, 50 Church Street, New York, under the management of the E. G. Long Company.

The Syntron Company, Pittsburgh, formerly the National Electric Manufacturing Company, manufacturer of the Syntron electric hammer, announces the following new offices and managers in charge: The Syntron-Boston Company, John L. Shea, manager, 308 Congress Street, Boston, and the Syntron-Detroit Company, E. Earl Beatty, manager, 5001 South Clarendon Street, Detroit. The following distributors have also been added to the sales organization: The Electric Sales Company, 138 Third Street, S.W., Canton, Ohio; the Arthur E. Jones Company, 415 S. A. & K. Building, Syracuse, N. Y.; the Imperial Machinery Company, 93-95 Sixteenth Street, Wheeling, W. Va.; the Roberts Electric Company, Sherman, Tex.; J. M. Wheeler, 2008 North Street, Harrisburg, Pa.; J. W. Bartholow Company, 1221 South Lamar Street, Dallas, Tex.; the Van Bernard-Neville Company, Kemper Building, Kansas City, Mo.; the Fort Wayne Pipe & Supply Company, 225-227 East Columbia Street, Fort Wayne, Ind., and the Home Equipment Company, 132 Third Avenue, N. Nashville, Tenn.

The Ohio Brass Company, Mansfield, Ohio, announces the development of a new malleable iron known as "Flecto" iron, which after it is galvanized will bend, is ductile and will not break in service. The company states that it has been using this iron in its products for the last two years, including such products as pole hardware, suspension insulator caps, strain clamps, etc.

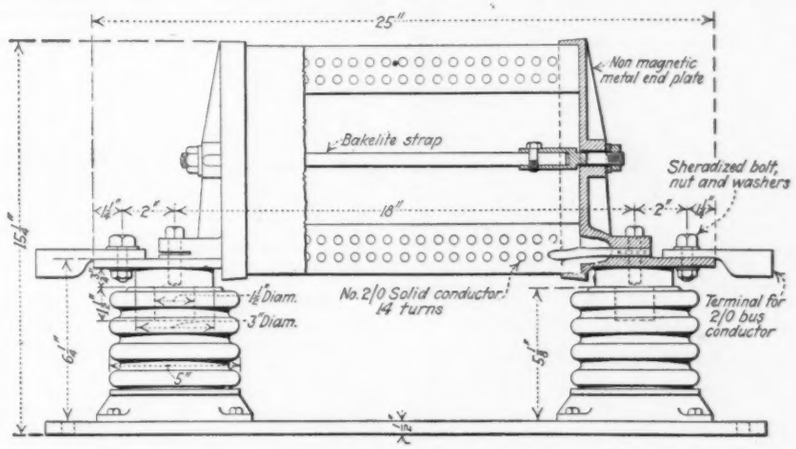
The Emerson Electric Manufacturing Company, 2012 Washington Avenue, St. Louis, manufacturer of motors, generators, fans, etc., has leased a seven-story brick building at Twenty-first and Olive Streets to provide for the expanding business of the company. The company only recently had leased the building adjoining its property on Washington Avenue.

The Graybar Electric Company, 100 East Forty-second Street, New York, formerly the supply department of the Western Electric Company, announces that H. N. Goodell has been made manager of the Kansas City branch of the company.

New Equipment Available

Reinforced Choke Coil

A new design of choke coil, illustrated herewith, is being marketed by the National Company, 110 Brookline Street, Cambridge, Mass., following two years' severe field service in which not a single unit has been reported destroyed by surges or lightning. The coil is embedded in a concrete cylinder reinforced by manila hemp (not shown) interlacing the copper turns; the core is hollow, and the end pieces are bronze clamps tied together by a bakelite strap which facilitates bolting the ends for maximum compression on the concrete. Terminals are designed to permit bolting the coil ends and connecting conductors to non-magnetic clamping pieces, and the complete coil is supported on post-type insulators. The coils are wound in single or parallel sets of turns, depending on the capacity needed, and the makers are now building these units in 200, 300, 400 and 600-amp. sizes and for 7,500-volt and 15,000-volt service. The coil units can be quickly detached and other sizes substituted if desired.



600-AMP., 7,500-VOLT REINFORCED CHOKE COIL

Reversing Motor Drive

An alternating-current motor drive that permits of reversal of rotation at full speed has been developed by the Westinghouse Electric & Manufacturing Company and is especially adapted to washers and drying tumblers. The motor, made in sizes of 2 hp., 3 hp., 5 hp. and 7½ hp., is of the squirrel-cage induction type built on a standard frame. It will stay within its temperature rating, reversing as often as every seven seconds. With this motor and control there is no sudden stopping and starting, but instead there is a smooth retardation and a similar acceleration. The control consists of a reversing switch actuated by a traveling nut mechanism, which is connected to the washer by a chain and gear.

Ground-Wire Clamps. — A ground-wire clamp designed to secure grounded wires permanently to Copperweld ground rods has been placed on the market by the Copperweld Steel Company, Rankin, Pa. The clamp is fastened by mechanical means, eliminating the use of soldered connections, although solder may be used with the clamp if desired. By means of a cup-shaped screw or bolt pressure is exerted on the wire or strand without stretching or bursting the clamp. This pressure flattens the wire or strand, materially increasing the contact area. Two clamps may be used where additional contact is required. Clamps for ⅝-in. and larger Copperweld rods are built to accommodate strands as well as solid wires. When properly tightened it is said that a pull of approximately one ton is necessary to cause wire or strand slippage.

New Trade Literature

SEPARATOR MAGNETS.—The Electric Controller & Manufacturing Company, 2700 East Seventy-ninth Street, Cleveland, has issued a leaflet on the use and methods of installing "E C & M" separator magnets. Illustrations are given showing typical installations of the separators.

ELECTRIC INSTRUMENTS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued catalog No. 8931, describing and illustrating its various instruments, medium and small sizes, including instruments for alternating and direct current for use in radio work, for checking the operation of motor starters and starting controllers, for power plants to check opens and shorts on relay circuits, and for other purposes.

FORCED-DRAFT STOKERS.—The Combustion Engineering Corporation, Combustion Engineering Building, New York City, is distributing catalog GFD-1, describing the "Green" forced-draft stokers for free-burning bituminous or lignite coal. It contains drawings showing typical installations of the stoker for burning various types of coal, including Illinois and Kansas bituminus screenings, Missouri slack screenings, No. 3 buckwheat and slush, free-burning bituminous coals, etc.

HAMMERS.—The Fermot Company, 200 Broadway, New York City, has issued a bulletin describing the "Simbi" electrically driven hammer for operation on alternating current.

POWER FACTOR.—"Power Factor and Means for Its Improvement" is the title of bulletin GEA232, issued by the General Electric Company, Schenectady, N. Y. The bulletin presents in a simple and systematic manner data and information which will enable a logical study of the means for power-factor improvement in industrial plants. The disadvantages of low power factor and the advisability of improving it are discussed and examples are given of the solution of power-factor problems. The induction motor, the synchronous motor, "capacitors" and synchronous condensers are also described and discussed. Tables giving the reactive kva. required to improve from one power factor to another, the amount of reactive kva. for each kilowatt of energy load at various power factors and the reactive kva. of standard listed three-phase, 60-cycle General Electric type KT induction motors are included.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency is desired in Venice, Italy (No. 19,513), for electrical automobile appliances, electrical household appliances, radio sets and parts.

Purchase and agency is desired in Copenhagen, Denmark (No. 19,588), for radio sets and parts.

An agency is desired in Manchester, England (No. 19,481), for electrical washing machines.

An agency is desired in Leipzig, Germany (No. 19,485), for insulated and uninsulated copper wire.

Purchase is desired in Wallisellen, Switzerland (No. 19,559), of special therated wire.

Purchase is desired in Melbourne, Australia (No. 19,480), of horizontal boring, surfacing and milling machines, including motor-starting apparatus and standard tool equipment and accessories.

Purchase and agency is desired in Buenos Aires, Argentina (No. 19,526), for grease cups for lubricating machinery.

Purchase and agency is desired in Charleroi, Belgium (No. 19,560), for precision tools for machinists, draftsmen and engineers.

DISTRIBUTION TRANSFORMERS FOR SYDNEY, AUSTRALIA.—Tenders will be received by the city of Sydney, Australia, according to *Commerce Reports*, until April 19 for three-phase distribution-type transformers. A copy of specifications has been received by the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., which will be lent to American firms in the order in which requests are received. Refer to number Australia 199,501.

POWER-PLANT EQUIPMENT FOR MELBOURNE, AUSTRALIA.—Specifications have been issued by the State Electricity Commission of Victoria, Melbourne, Australia, according to *Commerce Reports*, inviting tenders until May 24 on synchronous condensers and accessories. Copies are on sale in the New York district office, 734 Custom House, and the Chicago district office, 76 Monroe Street, of the Bureau of Foreign and Domestic Commerce.

ELECTRICAL MATERIAL FOR CHILEAN STATE RAILWAYS.—Bids will be received by the Chilean State Railways until June 28 for electrical material (group 32). Bids will also be received until July 9 for material for illuminating locomotives and wagons (group 32).

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

WEST BUXTON, ME.—Plans are under consideration by the Cumberland County Power & Light Company, Portland, for the construction of a new power plant, to be located a short distance from its present station. The cost is estimated at $500,000.

ATHOL, MASS.—Plans are under way for the installation of a new street-lighting system in the business section. All overhead wires will be removed from the main thoroughfare. The system will be installed by the Athol Gas & Electric Company.

NORWICH, CONN.—The installation of thirty-four additional ornamental lamps is contemplated by the Municipal Gas and Electrical Department this summer.

TERRYVILLE, CONN.—The Board of Selectmen is considering a petition for extensions in the street-lighting system on North Street to the North Plymouth district, a distance of about 2 miles.

WINSTED, CONN.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system in the downtown district.

Middle Atlantic States

BATH, N. Y.—Bids will be received by the Superintendent of Purchase, Capitol, Albany, until April 8, for electric work, replacement electric wiring, at the New York State Soldiers' & Sailors' Home, Bath.

BUFFALO, N. Y.—The Saskatchewan Co-Operative Elevator Company plans to install electric power equipment in the proposed addition to its local grain elevator, to cost about $600,000.

DANSVILLE, N. Y.—The Borough Council is considering the installation of a fire alarm system, to cost about $10,000.

GLOVERSVILLE, N. Y.—The Fulton County Gas & Electric Company has applied for permission to erect a transmission line to serve the town of Caroga and to exercise a franchise granted by the Town Board.

GOVERNORS ISLAND, N. Y.—Bids will be received by the Signal Corps, Procurement district, Governors Island, until March 25, for 32,000 ft. telephone cable and 57 cable reels (Circular 33).

MILLWOOD, N. Y.—The Westchester Lighting Company, Mount Vernon, plans to build a local outdoor switching station.

PORT CHESTER, N. Y.—The installation of a new fire-alarm system, to cost about $30,000, is under consideration by the Village Board.

WATERTOWN, N. Y.—Extensions of three transmission lines to serve farmers in the Three Mile Creek district, Camp Mills District and territory beyond the Tuberculosis Sanatorium, is under consideration by the Northern New York Utilities, Inc.

WYOMING, N. Y.—The Niagara, Lockport & Ontario Power Company has petitioned for permission to erect a transmission line and for approval of a franchise to supply electricity to the municipal electric light plant.

ELIZABETH, N. J.—The Lidgerwood Manufacturing Company, 96 Liberty Street, New York, plans to install electric power equipment at its proposed local plant on Linden Avenue, Bayway, to cost about $210,000.

IRONIA, N. J.—The New Jersey Power & Light Company, Dover, plans to erect a transmission line to Ironia for local service.

ALLENTOWN, PA.—The Pennsylvania Power & Light Company has authorized the construction of transmission lines in the Conyngham and Sugarloaf Valleys, for light and power service at Rock Glen, Sybertsville, Buck Mountain and other towns.

HONESDALE, PA.—The installation of a new fire-alarm system is under consideration by the City Council.

PITTSBURGH, PA.—Hubbard & Company, 6301 Butler Street, plan to install electric power equipment in connection with the rebuilding of their plant, recently destroyed by fire with loss of about $750,000.

TARENTUM, PA.—Extensions and improvements to the municipal electric plant and waterworks, to cost $225,000, are contemplated by the City Council. Hudson & Myron, 802 Wabash Building, Pittsburgh, are engineers.

WILLIAMSPORT, PA.—The Board of County Commissioners has contracted with the Pennsylvania Power & Light Company, Allentown, for installing and maintaining an improved lighting system on different bridges in the county.

SALISBURY, MD.—The Eastern Shore Gas & Electric Company, which is erecting a high-tension transmission line from Salisbury to Ocean City, plans to develop an entirely new territory by furnishing electricity in the towns of Walstons, Parsonburg, Pittsville, Willards and Whaleyville, now without electrical service. Current will be supplied from the company's plant at Laurel, Del.

ALEXANDRIA, VA.—Plans are under way by the Alexandria Light & Power Company for extensions to the ornamental lighting system, to cost about $20,000.

SMITHFIELD, VA.—The Virginia Electric Power Company, Richmond, which has acquired the property of the Smithfield Power Company, plans extensions and improvements in the transmission lines and system.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until April 5 (postponed from March 25) for radio transmitters, terminal blades, chests, transformers, switches, etc. (Circular C. P. 23,000-B-1.)

WASHINGTON, D. C.—Bids will be received by the United States Coast Guard Headquarters, Washington, until April 1, for 10 to 35 oil engine generator sets, 8 kw., 32-volt d.c. for patrol boats; also, at the same time for 10 to 35 switchboards and equipment for use with 32-volt d.c. generator and storage battery.

North Central States

PETERSBURG, MICH.—The Detroit (Mich.) Edison Company which has been granted a franchise in Petersburg, plans to extend its transmission line to this place.

REED CITY, MICH.—The Consumers Power Company, Jackson, which has acquired the municipal electric plant, will erect a transmission line from Big Rapids, to supply electricity for local service.

ROMEO, MICH.—Plans are under way by the Detroit Edison Company for extensions and improvements in its local power plant.

CLEVELAND, OHIO.—Plans have been filed by the Cleveland Electric Illuminating Company for the erection of a substation at Clinton Avenue and West Ninety-fourth Street, consisting of a switch house, control house, and oil storage building, to cost about $225,000.

LOUISVILLE, KY.—Electric power equipment will be installed in the proposed plant of the Stimpson Computing Scale Company, to be located at Logan and Breckinridge Streets, to cost about $200,000.

INDIANAPOLIS, IND.—Preliminary plans are being prepared by Harrison & Turnock, 500 Board of Trade Building, for a power plant for the Indiana State Blind School, to cost about $150,000.

AURORA, ILL.—Plans are under consideration by the Chicago, Aurora & Elgin Railroad Company, the control of which has been acquired by the Samuel Insull, Chicago, and associates, for extensive improvements, to cost about $1,500,000. Under an arrangement with the Chicago Rapid Transit Company, the Wells Street Terminal in Chicago will be rebuilt at a cost of

$160,000, new cars will be purchased, right of way development, substations, will be built, etc.

CHICAGO, ILL.—Plans have been prepared by the Commonwealth Edison Company for the construction of a testing laboratory on California Avenue near Addison Street, to cost about $50,000.

JOLIET, ILL.—The construction of two new substations this year is under consideration by the Chicago & Joliet Electric Railway Company, to cost about $240,000. One will be located on the west side of the city and the other on the east side.

SPRINGFIELD, ILL.—Franchises have been granted to the Central Illinois Public Service Company in Maumie, Coatsburg, Cypress, Goreville and Olmstead. Street-lighting contracts have been secured at Meredosis, Stillwater, Manchester and Cypress.

SPRINGFIELD, ILL.—Application has been made by the Central Illinois Public Service Company to the Commerce Commission for permission to erect a 33,000-volt transmission line from Pana to Nokomis, and for authority to build a 6,600-volt line in Crossville and in Dieterich, and also to purchase the property of the Rossville Electric Company, operating in Rossville, Hoopeston and Alvin, and the electric distributing system in Cypress.

ALGOMA, WIS.—Plans have been approved by the City Council for the reconstruction of the ornamental lighting system and the removal of all arc lamps now in use.

BURLINGTON, WIS.—The City Council has accepted the proposal submitted by the Wisconsin Gas & Electric Company, Racine, for the installation of ornamental lamps in the business section and an improved lighting system in the residential district.

DOLGEVILLE, WIS.—The construction of a cold storage and refrigeration plant is under consideration by the Dolgeville Cheese Federation, to cost $40,000.

FOND DU LAC, WIS.—Plans have been completed by the Wisconsin Power & Light Company for the erection of a transmission line between Oakfield and Oak Center, 28 miles long, for rural service chiefly. The company plans to expend about $1,000,000 in building rural line extensions to serve farmers this year.

JANESVILLE, WIS.—Plans are being prepared by the Wisconsin Power & Light Company, Madison, for rebuilding its power plants and substations in this district.

MADISON, WIS. — The installation of ornamental lamps on East Main Street is under consideration by the City Council.

RACINE, WIS. — Plans have been approved by the Wisconsin Gas & Electric Company for the installation of new street-lighting equipment.

CANBY, MINN. — All bids submitted March 4 for an ornamental lighting system have been rejected. New bids will be asked for later.

FERGUS FALLS, MINN.—The construction of new power plants at Grand Forks and Washburn, N. D., are under consideration by the Otter Tail Power Company.

MINNEAPOLIS, MINN.—The Park Commission is considering tentative plans for the installation of ornamental lamps on Memorial Drive, Glenwood Parkway, Cedar Lake Boulevard, Calhoun Boulevard and River Road. A. E. Berthe is park engineer.

ROCHESTER, MINN.—All bids submitted to the Board of Education on Feb. 25 for the construction of a central power have been rejected. The project will be postponed until 1927.

SHAKOPEE, MINN.—The City Council has authorized the installation of an ornamental lighting system in the downtown district.

TYLER, MINN.—Plans are being considered by the Town officials for the erection of a high-tension line from Tyler to Ruthton to connect with the lines of the Northern States Power Company from Pipestone.

ANITA, IOWA.—The Iowa Electric Company, Cedar Rapids, plans to erect a high-tension transmission line from Anita to connect with the Massana-Bridgewater line.

CEDAR RAPIDS, IOWA.—Permission has been granted the Iowa Electric Company to increase the voltage of its transmission line in Iowa and Keokuk Counties from 13,200 to 33,000.

CEDAR RAPIDS, IOWA. — Electric power equipment will be installed in the proposed mill to be erected by the Quaker Oats Company, Chicago, at Avenue B and Second Street, to cost about $400,000.

LOUISIANA, MO.—The property of the Louisiana Light & Power Company has been acquired by A. H. Latimer and J. W. Peterson. The new owners plan to install a new ornamental lighting system and to erect a transmission line to Clarkesville, Bowling Green, Eolia and Elsberry.

ST. LOUIS, MO.—The Polar Wave Ice & Fuel Company, 3638 Olin Street, plans to build an ice-manufacturing and refrigerating plant on Ninth Street to cost $300,000.

MANKATO, KAN.—Petitions are being circulated for the installation of ornamental lamps on Main and Commercial Streets.

COLUMBUS, GA.—The Muscogee Manufacturing Company, plans to install electric power equipment in the proposed addition to its local textile mill, to cost about $500,000.

WAKEENEY, KAN.—The Kansas Central Power Company, Abilene, has petitioned for permission to erect a transmission line from Wakeeney to Hays.

Southern States

COLERIDGE, N. C. — The Enterprise Manufacturing Company plans to build a power plant at its local textile mill. Lockwood, Greene & Company, Charlotte, are architects and engineers.

ATLANTA, GA.—Plans are under way by the Georgia Railway & Power Company for the erection of a 38,000-volt transmission line, 20 miles in length, from Marietta to Breman, to supply service in Douglasville, Powder Springs, Villa Rica, Bremen, Waco and Temple. Distribution systems will be built in the towns or the present system will be taken over.

CEDARTOWN, GA.—The Goodyear Tire & Rubber Company, Akron, Ohio, plans to install electric power equipment in connection with proposed extensions at its local plant, to cost about $200,000. Lockwood, Greene & Company, Atlanta, are architects and engineers.

ORLANDO, FLA.—The budget of the Florida Public Service Company for 1926 calls for an expenditure of $4,000,000, of which $2,000,000 will be used for permanent extensions and betterments to the system extending 150 miles throughout the central part of the state. Another $2,000,000 will be spent on a new steam power plant, which is to be a duplicate of the Broad River Power Company's plant at Parr Shoals, S. C. Construction work is already under way at Benson Springs on Lake Monroe. The company is now erecting a 110,000-volt transmission line to connect the new Benson Spring plant with that at Lake Wales.

BIRMINGHAM, ALA.—Surveys are being made by the Alabama Power Company for the erection of a transmission line across Lawrence County from Muscle Shoals to Cullman.

BILOXI, MISS.—Bids, it is understood, will be asked by the Board of Public Works in about thirty days for the installation of an ornamental lighting system, consisting of 144 ornamental standards complete with lamps, and 23,000 ft. steel taped, lead-covered No. 8 parkway cable.

PURVIS, MISS. — Extensions and improvements are contemplated by the Purvis Public Service Company to its light and power plant, to cost about $75,000.

EL DORADO, ARK.—Steps have been taken by property owners on Cedar Street to install ornamental lamps on that thoroughfare from Washington Street to the Missouri Pacific Railroad Station.

TEXARKANA, ARK.—Plans have been prepared for the installation of a second ornamental lighting system in the business district.

HARRISON, ARK.—The City Council is considering a proposal submitted by the Southwest Power Company, McAlester, Okla., to install ornamental lamps around the square.

BROWNSVILLE, TEX.—Plans are being prepared by the Brownsville Ice & Cold Storage Company to build an ice and cold storage plant, to cost $100,000.

LAREDO, TEX. — The Texas Central Power Company, San Antonio, contemplates improvements to its local properties, including electric plant, waterworks, etc., to cost about $1,000,000.

NACOGDOCHES, TEX. — The Texas Power & Light Company, Dallas, is negotiating for the purchase of the local municipal electric plant, and plans extensions in transmission lines for service here.

SKIDMORE, TEX.—The Texas Central Power Company, San Antonio, plans to build a local light and power plant.

Pacific and Mountain States

MEDICAL LAKE, WASH.—Plans are being prepared by the Board of Trustees, Eastern Washington Insane Hospital, for a power plant at the institution, to cost about $50,000. Julius Zittel, Auditorium Building, Spokane, is architect.

SEATTLE, WASH. — The Washington Cement Company, recently organized, plans to install electric power equipment in its proposed cement mill on the Seattle tideflats, to cost $1,500,000. Philips Morrison, Leary Building, is interested in the company.

WHITE BLUFFS, WASH. — Electric power equipment will be installed in the proposed cold storage and refrigerating plant to be built by the White Bluffs Warehouse Company, to cost $100,000.

NORTH BEND, ORE.—The Stout Lumber Company plans to install electric power equipment in connection with the rebuilding of its local mill, recently destroyed by fire. The cost is estimated at $300,000.

BANNING, CAL.—The Board of City Trustees is considering extensions and improvements in the street-lighting system.

COLTON, CAL.—The installation of ornamental lamps on Ninth Street, from La Cadena Street to I Street, is under consideration by the City Council.

LA VERNE, CAL.—The installation of an approved lighting system in the business district is under consideration. Paul P. Meyers is chairman of the street-lighting committee.

LONG BEACH, CAL.—Bids will soon be asked by the City Council for ornamental lamps (metal standards) on Atlantic Avenue, to cost about $70,000. R. D. Van Alstine, is city engineer.

LOS ANGELES, CAL.—The City Council is considering plans for the installation of ornamental lamps in portions of Allen, New York, and Sinaloa Avenues, Meadowbrook Road and Baker Street.

MARYSVILLE, CAL.—The Pacific Gas & Electric Company, San Francisco, has appropriated $30,000 for the construction of a local machine and mechanical repair shop.

POMONA, CAL.—Plans are being prepared by the Southern California Edison Company, Los Angeles, for a substation at First and Parcells Streets.

PASADENA, CAL.—Plans are under way by the Southern California Edison Company, Los Angeles, for the construction of an equipment storage and distributing plant on the Union Pacific Railway right-of-way, near Logan Street, to cost about $75,000.

SAN FRANCISCO, CAL.—The erection of an electric transmission line from Newark to San Francisco, along the Bay Shore is under consideration by the officials of the city of San Francisco and San Francisco County. Funds to the amount of $20,000 have been appropriated to finance the survey. M. M. O'Shaughnessey is city engineer.

GREAT FALLS, MONT.—The installation of an improved lighting system on Seventh Avenue between Park Drive and Twenty-third Street, is under consideration by the City Council.

CHEYENNE, WYO. — Plans are under consideration for the installation of an improved lighting system, covering the territory between Eighteenth Street, Carey and Morris Avenue.

Canada

BATHURST, N. B.—Arrangements are being made by the Bathurst Company for construction of storage dams and additional power units on the Nepisiguit River, to cost about $1,750,000, work on which will begin as soon as authority is obtained from the provincial legislature. The company is also planning to build an additional newsprint mill. The total cost of the project is estimated at $5,000,000.

CHELSEA, QUE.—The construction program of the International Paper Company, 100 East Forty-second Street, New York City, in the vicinity of Ottawa calls for two hydro-electric plants, one at Chelsea, about 9 miles north of Ottawa, on the Gateineau River, and one at Farmers Rapids, just below Chelsea. These two plants will have an initial capacity of 200,000 hp., with provision for further extensions. The plants will supply power to the company's new mill at West Templeton and other industries in that district.

Electrical Patents

Announced by U. S. Patent Office

(Issued Feb. 16, 1926)

1,573,152. TIME SWITCH FOR ALARM SYSTEMS; P. A. Friel, Richmond Hill, N. Y., App. filed March 20, 1924. For use in connection with water pipes or mains adapted to indicate that a flow of water is taking place.

1,573,155. RECTIFIER WITH A CHANGE-OVER SWITCH; H. Gerdien, Berlin-Grunewald, Germany. App. filed April 4, 1922.

1,573,163, 1,573,164. ELECTRIC SWITCH; G. H. Hart, West Hartford, Conn. App. filed March 8, 1923. Snap switch.

1,573,170. COMBINATION LOCK; C. C. Knottingham, W. S. Knottingham and J. F. Otis, Roxboro, Wash. App. filed Nov. 26, 1923. Of the electrical type for use in safes, vaults and other appliances.

1,573,179. ELECTRIC SWITCH; J. N. Mahoney, Brooklyn, N. Y. App. filed July 28, 1921. Adapted to interrupt current of considerable magnitude by dissipating gradually energy liberated upon circuit interruption as by utilizing said energy to set in motion relatively massive bodies, as bodies of oil in the switch, whereby the energy will be absorbed by said moving bodies and circulate the oil and subsequently bring the oil to rest gradually, whereby to dissipate the energy of movement therein and at such a moderate rate that the energy dissipation may be accomplished without undue strain on the switch.

1,573,187. THERMAL ELECTRIC CIRCUIT CONTROLLER; G. W. O'Keeffe, Dorchester, Mass. App. filed April 28, 1922. The thermally expansible element and associated elements are contained within a tubular inclosing casing adapted to be received in spring clips in a manner similar to a cartridge-type inclosed electric fuse.

1,573,207. ELEVATOR MOTOR CONTROLLER; E. B. Thurston, Toledo, Ohio. App. filed Aug. 23, 1919. For readily bringing the car to landing positions under various load conditions.

1,573,235. CIRCUIT BREAKER; C. S. Eppley, York, Pa. App. filed July 27, 1923. For use in connection with an electric control panel for automatic railway switches.

1,573,298. STORAGE-BATTERY TERMINAL POST CLAMP; M. Brown, Chicago, Ill. App. filed May 5, 1922.

1,573,333. DYNAMO-ELECTRIC MACHINE; H. M. Stoller, Mountain Lakes, N. J. App. filed March 15, 1924. To provide for operating two or more series-wound machines in step with one another both during acceleration and at synchronous or at running speeds, to adapt such machines for use in simultaneous recording of pictures and sounds and to the simultaneous reproduction of pictures and sounds.

1,573,335. ARRANGEMENT FOR THE COMPENSATING WINDINGS OF COMMUTATOR MOTORS WITH SALIENT POLES; L. Torda, Budapest, Hungary. App. filed March 22, 1924.

1,573,337. ELECTRICAL BRIDGE; H. J. Vennes, New York, N. Y. App. filed July 20, 1920. Of a simple style for measuring the impedances of devices such as condensers, coils or lines.

1,573,371. OIL-CIRCULATION SIGNAL; A. Bloch, Philadelphia, Pa. App. filed April 19, 1921.

1,573,392. RENEWABLE FUSE ELEMENT; J. B. Glowacki, Chicago, Ill. App. filed Aug. 8, 1923. Single and multiple fuse elements for cartridge fuses wherein it is impossible to increase the capacity of the fuse as originally assembled at the factory; as the fuse element will be replaceable only by another of the same capacity.

1,573,402. CONDUCTIVE BRUSH AND METHOD OF SECURING ATTACHMENTS THERETO; A. F. Herman, Cleveland, Ohio, and H. S. Ellson, Lakewood, Ohio. App. filed May 19, 1924.

1,573,432. RENEWABLE FUSE; G. R. Trumbull, Bantam, Conn. App. filed Aug. 29, 1921. For rendering overloading very difficult or practically impossible.

1,573,440. OUTLET FITTING; R. B. Benjamin, Chicago, Ill. App. filed Nov. 21, 1917. Whereby various electrical fixtures and devices can be interchangeably installed quickly and easily and without disturbing the wiring system.

1,573,508. ELECTRIC MOTOR FOR USE ON A CONSTANT-CURRENT VARIABLE-VOLTAGE SYSTEM; G. Austin; J. C. Macfarlane and W. A. Macfarlane, Glasgow, Scotland. App. filed Oct. 10, 1924. Motor having fixed brushes, which motor will automatically give (above normal speed) torque-speed characteristics equivalent, as may be desired, to a series, shunt or compound motor operating on the parallel system.

1,573,546. INDUCTION ELECTRICITY METER; J. Harris, Lafayette, Ind. App. filed June 15, 1925. Watt-hour meter; the prevention of errors in such a meter due to temperature changes.

1,573,601. ARTICLE CONTAINING VISIBLE TEMPERATURE RECORDS AND METHOD OF OBTAINING THE RECORDS; C. T. Fuller, Nutley, N. J. App. filed Jan. 26, 1922. As in the manufacture of articles such as incandescent electric lamps and similar articles which are heated at some stage of their manufacture to a predetermined temperature.

1,573,606. METHOD AND APPARATUS FOR MAKING ELECTRICAL MEASUREMENTS; T R. Harrison, Philadelphia, Pa. App. filed May 3, 1924. Measurements of current and potential values to indicate or record changes in electrical, physical, chemical or like conditions, such as occur, for example, when making pyrometric measurements.

1,573,622, 1,573,623, 1,573,624. PROTECTIVE SYSTEM; J. Biermanns and O. Mayr, Karlshorst, Germany. App. filed Oct. 17, 1924. Involving the use of relays in which current and potential windings cooperate to provide a discriminating action dependent on the distance between the point of fault and the relay location or on the direction of the flow of power at the relay location.

1,573,674. ELECTRICALLY OPERATED ELECTRIC SWITCH; G. A. Burnham, Saugus, Mass. App. filed Sept. 9, 1921. Oil-immersed electric switches particularly adapted to be automatically controlled, as automatically opened and automatically closed.

1,573,710. ELECTRICAL SWITCH INCLOSURE OR CABINET; B. D. Horton, Detroit, Mich. App. filed June 16, 1922. An improved form of cabinet knockout and trough-fastening means.

1,573,717. LAMP LOCK; C. Killars, Stonington, Conn. App. filed Aug. 5, 1922. An attachment for lamps of the incandescent type which operates to prevent theft of the lamp.

1,573,787. ELECTRIC HEATER; C. P. Randolph, Oak Park, Ill. App. filed May 25, 1925. Electric flatiron.

(Issued Feb. 23, 1926)

1,573,802. ELECTRIC SAFETY COMBINATION LOCK; L. Cadenel, Paris, France. App. filed Jan. 15, 1923. Door to be locked without the use of a key, it being possible to open and close it only when in possession of the secret of the combination.

1,573,838. THERMOSTAT; J. Keller and H. Künstlich, New York, N. Y. App. filed Feb. 21, 1924. For giving an alarm automatically when the temperature of a building or room in which the device is situated exceeds a predetermined amount or value.

1,573,883. DYNAMO-ELECTRIC PLANT; M. A. Vining, Elyria, Ohio. App. filed June 2, 1921. Which employs an internal-combustion engine directly connected to a generator and having the same mounted as a unit on a common base; semi-automatic in control.

1,573,904. SWITCH-ACTUATING MECHANISM; C. N. Bergmann, Pittsburgh, Pa. App. filed Feb. 23, 1922. Selective type; for use in connection with transformers or similar mechanism.

1,573,925. SOLDERING IRON; D. E. Franke and N. G. De Vries, Brooklyn, N. Y. App. filed July 11, 1924. In which a removable carbon element is employed as the soldering point.

1,573,944. SWITCH CONTROL FOR ELECTRIC HAIR DRIERS; B. F. Jancke, New York, N. Y. App. filed May 18, 1925.

1,574,020. ELECTRIC CORD PROTECTOR; S. D. Black and A. G. Decker, Baltimore, Md. App. filed May 19, 1923. For portable electric devices.

1,574,039. THEFT-PROOF DEVICE FOR WATT-HOUR METERS; F. A. Kolb, Hammond, Ind. App. filed May 23, 1924. By replacing the bushing and terminal which is connected to the load side of the current coil of the meter with a special bushing and terminal and connecting this terminal electrically to a point which will give a part of said special terminal an electrical potential opposite to the electrical potential of the main part of said terminal.

1,574,053, 1,574,054. ELECTRIC WATER HEATER; S. D. Nesmith, San Diego, Cal. App. filed Oct. 8, 1923. Automatic.

1,574,059. COIL-WINDING MACHINE; C. D. Reynolds, Cranston, R. I. App. filed Jan. 14, 1924. For winding electrical coils with strips of paper or other insulating material inserted between the layers of wire or conductor forming the coil.

1,574,064. ELECTRICAL CONNECTION FOR TRANSFORMERS AND THE LIKE; G. L. Chamberlain, Chicago, Ill. App. filed July 21, 1922. Capable of ready shifting or adjustment to vary the output of the transformer.

1,574,076. HIGH-VOLTAGE CABLE AND METHOD OF MAINTENANCE; H. W. Fisher, Perth Amboy, N. J. App. filed Feb. 5, 1925. Hollow cable. The combination of a conductor, an envelope of permeable insulation surrounding the conductor, an impermeable sheath surrounding the whole, the opposite surfaces of the envelope of insulation being accessible to a stream of liquid insulating material, a conduit for liquid leading to the envelope of insulation over one of the opposite surfaces thereof, and a body of liquid insulating material under pressure filling the said envelope of permeable insulation and the approach thereto through said conduit.

1,574,108. ELECTRIC FURNACE; F. J. Peterson, Detroit, Mich. App. filed March 16, 1925. For heating a piece of stock used to form bolts, gears, etc.

1,574,129. SAFETY SWITCH FOR OIL-BURNING SYSTEMS; I. E. Smith, Stockton, Cal. App. filed May 11, 1925.

1,574,141. WAFFLE IRON; W. W. Weir, Alameda, Cal. App. filed Feb. 21, 1924.

1,574,193. ELECTRIC PAINT BURNER; W. W. Haslett and J. Blair, Baltimore, Md. App. filed July 3, 1924.

1,574,194. ELECTRIC SWITCH; P. C. Hewitt, Ringwood Manor, N. J. App. filed March 17, 1916. Using an evacuated container having electrodes therein.

1,574,242. ELECTRIC DRIVING INSTALLATION; W. Frensdorff, Bremen, Germany. App. filed July 23, 1925. Making use of the return current generated in electric drives operating with direct-current compound machines in particular installations for driving ship cranes, during lowering, for decreasing the load on the dynamo and on the prime mover.

1,574,296. ELECTRIC LIGHT FIXTURE; V. Le Beau (deceased), New Orlean, La. App. filed Dec. 29, 1924. Commercial type.

1,574,297. ELECTRIC CABLE; C. L. Lilleberg, Chicago, Ill. App. filed Dec. 7, 1921. Whereby the wires of the cable are accessible along the length of the cable for circuit connection.

1,574,308. ELECTRIC HEATING UNIT; E. A. Rutenber, Milwaukee, Wis. App. filed Aug. 22, 1924. As used on ranges.

1,574,343. HAIR-DRYING MACHINE; E. O. Frederics, New York, N. Y. App. filed Oct. 14, 1921.

1,574,346. THERMOSTAT; J. G. Goodhue, Evanston, Ill. App. filed July 19, 1923. Comprising expansible and conducting fluids wherein the fluid expansion causes the conducting fluid to make or break an electrical contact.

1,574,350. ELECTRICAL TESTING; J. B. Johnson, Elmhurst, N. Y. App. filed Aug. 14, 1923. Instrument for determining hysteresis losses, especially in closed magnetic circuits.

1,574,417. SWITCH; H. W. Cheney, Milwaukee, Wis. App. filed Oct. 29, 1919. Involving two circuit-closing positions, a starting position and a running position.

1,574,449. TRAFFIC-CONTROL SIGNAL; G. S. Simons, Plainfield, N. J. App. filed Jan. 10, 1924. Signal post for controlling traffic at intersecting streets.

1,574,508. THERMAL ELECTRIC CIRCUIT CONTROLLER; G. W. O'Keeffe, Dorchester, Mass. App. filed April 28, 1922. Circuit controller adapted to be received in and supported by spring clips similar to a cartridge-type electric fuse. A thermal circuit controller with an electrical heating element for the thermal element and with means for applying heating elements of various capacities to the controller whereby the controller may be adjusted to operate at various different values of current passed through the heating element.

1,574,531, 1,574,532. CIRCUIT INTERRUPTER; C. D. Ainsworth, Wollaston, Mass. App. filed Dec. 14, 1921. Electrically operated oil switch adapted to be inclosed removably in cells.

1,574,533. ELECTRIC SWITCH; C. D. Ainsworth, Wollaston, Mass. App. filed Feb. 9, 1922. Oil-immersed type, having movable and stationary contact or arcing members by which the magnetic effect of the current carried by them acts to improve the electrical engagement of the coacting contact members.

1,574,548. METHOD AND APPARATUS FOR SWITCHING; M. G. Benjamin, Lakewood, Ohio. App. filed March 31, 1924. Applicable to the switching of an electrical power-consuming device, such as the field of an electric motor, from one source of current to another.

1,574,578. SELF-LOCKING SEAL NUT; C. E. Holmes, Lynn, Mass. App. filed April 19, 1924. For watt-hour meters.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Evolution of the Private Generating Plant

AMONG the many basic factors underlying American industrial supremacy is the ever-present willingness to try out new methods and new applications which it is believed will result in greater productive efficiency. The industrial executives and engineers of this nation have always looked with favor upon any new system, machine or type of motive power which would thus increase efficiency, cost less to use or operate and tend toward a greater reliability of plant operation.

It is not surprising, therefore, that the manufacturing plants of the nation should have greeted the advent of the electric motor with great enthusiasm and that the infant electric light and power industry of the eighties and nineties should have been unable to meet the immediate demands of industry for electric power. The creation of large generating plants, long transmission lines and complicated distribution systems has been the evolution of decades, a task entirely beyond the ability of the early local central generating companies.

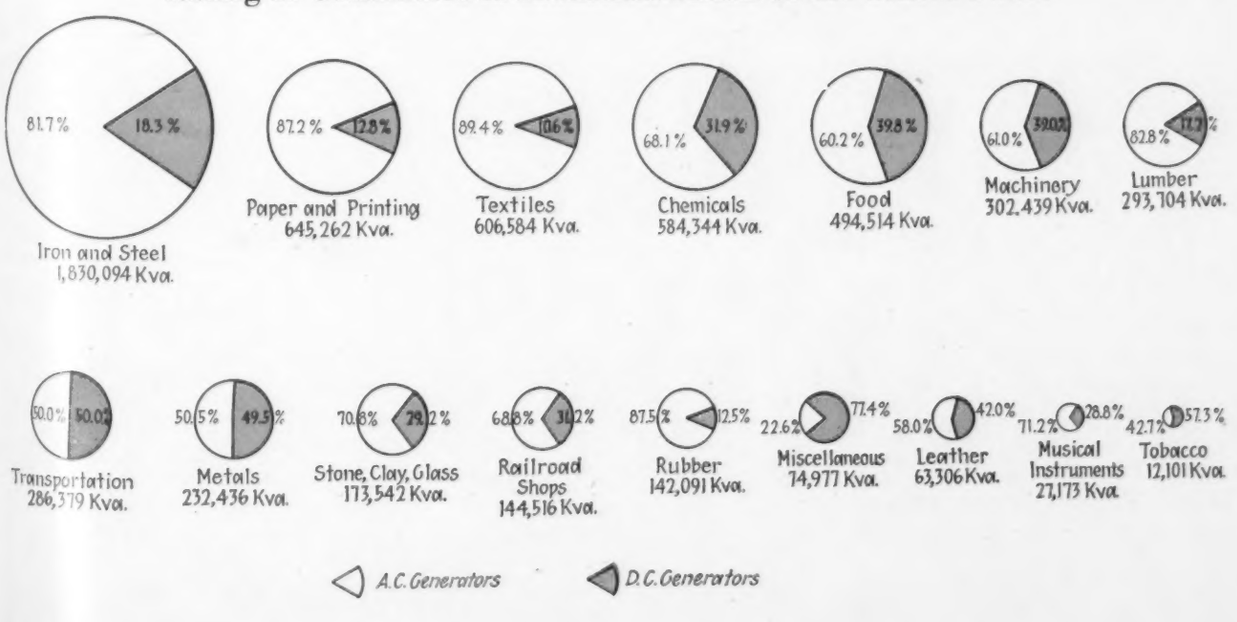
As a result of this demand for electrical energy by industrial plants and the inability of the newly created light and power companies to meet it, the larger manufacturing plants in great numbers installed their own electric generators and created specially trained engineering staffs of no small proportions. This trend toward private energy generation continued in greater and greater degree, reaching its greatest relative importance in 1904, when approximately 72 per cent of the rating of the motors installed in the manufacturing plants of America were run by energy generated in private electric generating plants.

But during this twenty-year period the electric light and power companies of the country had been gaining strength. Public confidence was being won, resulting in a greater investment of money in the industry. Larger generating plants with more efficient electric equipment were being constructed. Longer and higher-voltage transmission lines were being built, and the distribution lines were being extended to reach all parts of the territory served. As a result of these advances by the electric light and power companies the power requirements of the industrial plants were being more and more easily met, and the need for private generating plants became less and less. Manufacturing executives came to realize that here were available the services of an organization expert in power production and that to use its facilities would permit the elimination of the troublesome problem of power production, with its specially trained staff, engineering and fuel purchases and inefficient and undependable operation.

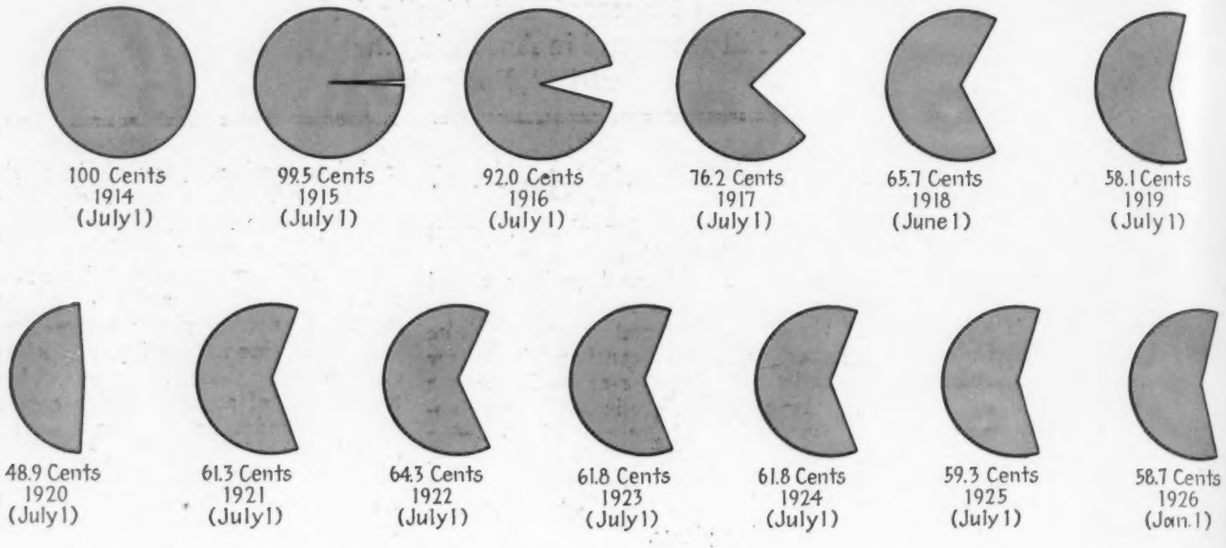
The turn in the relative use of private and centrally generated energy which took place around 1904, while not entirely ending the growth of the private plant, yet has confined that growth in the main to plants which use a very large amount of energy, or to mills and factories which on account of their isolation do not have access to central-station service. Today about 60 per cent of the total rating of the motors in the manufacturing plants of the country are run by energy generated in central generating plants. The iron and steel industry is the only one generating a major portion of its electrical energy.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who use these statistics would give credit to the ELECTRICAL WORLD.

Rating of Generators in Industrial Plants of the United States



The Purchasing Power of the Dollar Today Is Only About One-Half that of 1914



Data furnished by National Industrial Conference Board

The Industry Conquers the Dollar

THE purchasing power of the dollar is a matter of vital interest to every individual and to every branch of American industry. The mere word "dollar" expresses little. It is the economic worth of that "dollar" which tells the true story.

The American dollar has been cutting some very undignified capers since 1913. Taking the 1913 dollar at its full worth, 100 cents, its value declined as the war progressed until at the end of the war it was worth only 58.1 cents. This drop in purchasing value continued through 1920, reaching its low point in July of that year, when it was quoted at only 48.9 cents. Then it took an upward turn, reaching 64.3 cents in 1922, when it again started downward until the opening of the present year found the 1913 100-cent dollar worth only 58.7 cents.

The direct reflection of this drop in purchasing power of the dollar has been an almost continual rise in wages, which, in conjunction with an increase in the cost of raw products and fuel, has in turn been reflected in a material rise in the price of commodities to the ultimate consumer. Today the average citizen expects to pay a high price for any commodity. In fact, he looks at it askance if a low price is quoted.

In the midst of this general economic condition the electric light and power industry stands out in bold relief. Here is an industry which, in spite of high wages, high cost of apparatus and construction material of all kinds and high cost of fuel, has been able to cut the price of electrical energy to the consumer in the large cities by 9.9 per cent since 1913. Not only has the actual electric bill of the nation been materially reduced during this period, but through increased lamp efficiency the actual amount of illumination purchased per dollar has been increased from 9,903 candle-hours to 16,500 candle-hours, an increase of 67 per cent. Also, during this period the central station has so perfected its service through interconnection and better operating methods that today the American public has a better electric service than the people of any other nation.

The fabricated structure of the electric light and power industry is permeated by an intrinsic worth which enables it to rise above general economic conditions in a way equaled by few other primary industries. It is such assets as these, backed by wise operating policies, that have made the industry the acknowledged efficient public servant that it is.